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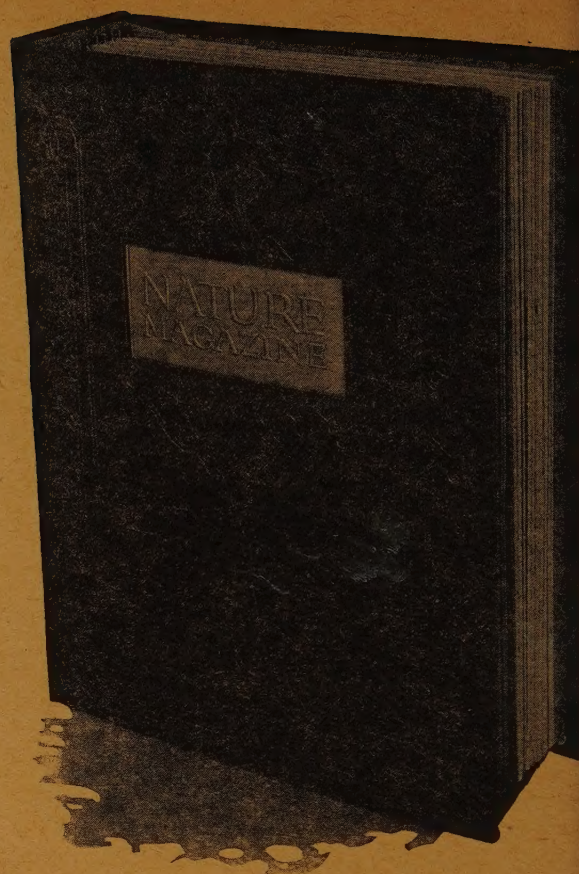
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Illinois U Library Dictionary

Concise Chemical and Technical Dictionary. Edited by H. Bennett. Brooklyn, New York. 1947. The Chemical Publishing Company. 1055 pages. \$10.00.

Fifty thousand definitions are included in this dictionary, covering such fields as chemistry, metallurgy, pharmacy, plastics, physics, mineralogy, electricity, engineering, trade name products and others. The volume is well cross-referenced and the definitions are useful alike to professional and layman.

Australia's Furred Folk

Furred Animals of Australia. By Ellis Troughton. New York. 1947. Charles Scribner's Sons. 374 pages. Illustrated by 25 plates in color by Neville W. Cayley. \$5.00.

This is a complete and popular guide to the egg-laying, pouched and non-marsupial mammals of Australia and Tasmania. Many people think of Australia as supporting a mammal population made up of marsupials, overlooking the fact that its fauna contains many other native mammals of special interest. More than four hundred species are covered in this volume, and almost half of them are pictured in Mr. Cayley's color plates.

Grand Canyon Plants

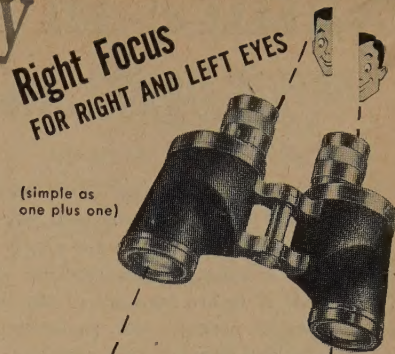
Plants of Grand Canyon National Park. By W. B. MacDougall. Grand Canyon, Arizona. 1947. Grand Canyon Natural History Association. 126 pages. Fifty cents.

This is a third edition of this checklist of Grand Canyon National Park plants, brought up to date with inclusion of added material gathered as knowledge of the flora of the Park has improved. It has a primary appeal to botanists and is not intended as an identification text.

Time

Time, Knowledge and the Nebulae. By Martin Johnson. New York. 1947. Dover Publications. 189 pages. \$2.75.

The subtitle of this book is: "An introduction to the meanings of Time in physics, astronomy and philosophy, and the Relativities of Einstein and Milne." The author seeks to dissect out some of these meanings, to the end that the resulting view of the nature and structure of scientific knowledge may serve to explain the obstacles which prevent the philosopher from formulating his more ultimate question as to the reality of time in human destiny, a question inaccessible to physics itself. It is, therefore, aimed not merely for the research specialist in mathematical physics, astronomy or logic, but is intended for the working scientist or student, and for that segment of the general public demanding to know where scientific attitudes might lead.



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Nature in Print

By HOWARD ZAHNISER

GETTING Nature into print is an enterprise in which many men and women are engaged, for, like love, it is a subject that seems to have for nearly all of us a curiosity touched with emotion, or an emotion spiced with curiosity, and nearly all of us are for most of our lives curious and emotional. From our writers—our professional expressors of our emotions and satisfiers of our curiosity—we expect in every generation a generous literature of Nature and find our expectations met. It is also our good fortune, time and again, to find this literature enriched from unexpected sources, to realize that in a house of many mansions there are also many interpreters, some of them rising from unexpected corners.

Who would have thought on the 1939 New Year's Day when Stanley P. Young—ex-cattle rancher, Government wolf hunter and trapper, Federal administrator of predator and rodent control—settled into a quiet nook among cases of mammal skins and skulls to collaborate with Biologist E. A. Goldman on a Government wolf report, that in less than a decade he would be an appreciated and proud author of four volumes?

It was not so surprising, of course, when the projected North American Fauna on which Messrs. Young and Goldman were collaborating developed into the 660-page *The Wolves of North America*, published by the American Wildlife Institute in 1943 with 137 half-tones, 6 color plates, and 10 maps. That was an understandable growth of a project, although it was somewhat surprising (and entirely pleasing) to note the lore that Mr. Young had written into his part of the work, and the flair with which he had obviously wrought his data into sentences and paragraphs.

Nor is it precisely surprising to see in *The Puma: Mysterious American Cat* (which was authoritatively reviewed in this magazine by Edward A. Preble) a second product of this collaboration, now, alas, terminated by the death of E. A. Goldman—the naturalist and taxonomist who gave to these volumes their technical validity and their scientific classifications of races, and who must have had his closing years much enlivened by the lusty veteran of the open ranges across the desk, who was just as likely to say “prince of predators” as “*Felis concolor*.” Certainly it is to Mr. Young that we owe the pleasure of such enjoyments as finding on page 2 of this definitive volume a quotation from James Whitcomb Riley:

“Yes—and painters, prowlin’ ’bout,
Allus darkest nights. Lay out
Clost yer cattle. Great, big red
Eyes a-blazin’ in their head,
Glitter’n ’long the timber-line—
Shine out some, and then unshine,
. . .”

The wolf work had, indeed, led us to expect that this unorthodox writer of Government reports would not be able to understand why anything interesting in conversation would not prove just as useful in formal print.

But who would have expected this writer to have two other volumes on the same new-book shelves to which *The Puma* was introduced? There are few professional writers who have the satisfaction of opening three new books of their own authorship in one six-weeks period, but Stanley P. Young has had

it in a degree that might properly be described as elation.

Here is a volume, well titled *Sketches of American Wildlife*, that is as meaty and as unpredictable as a lunch-time conversation with its author, and stops abruptly with this diminuendo: “If, gentle reader, in all of what has gone before, you have found nothing that has added to your present knowledge, then a concluding statement . . . would be: ‘After all there’s really nothing new under the sun.’” But the gentle reader is not likely to find this nothing added, nor is he likely at the conclusion of this volume to believe so readily that there is nothing new under the sun. The last chapter itself, called “Random Shots from Research,” is a fact-packed rambling that is indeed unpredictable. As Mr. Young observes at its beginning, his “study has necessitated dipping into hundreds of rare old volumes,” and he introduces himself in what he calls “the poetical words of one early outdoor writer on the natural history of western wild mammals”—

“Tho this work be ragged,
Tattered and jagged,
Rudely rain-beaten,
Rusty, moth-eaten,

If ye take well therewith
It hath in it some pith.”

Canada Geese

By DANIEL SMYTHE

Contending with the wind, the skies,
This is the wedge they make.
The wings beat and rise
Always over land, over lake,
Bent on a southern track.
We watch them in the light,
But they do not look back.
We see the leader draw
The progress of the birds
At home on any flight,
Obedient to some law
Outside of papered words.

Sketches of American Wildlife has indeed “in it some pith,” and surely there are many who will “take well therewith.” There is much information in such sketches as “Our Rare ‘Black Boots’ of the Prairie,” on the black-footed ferret; “It Lives—Without Water,” narrating not only the natural history of the prairie dog, but also the unusual experiences of a Peter and Abigail sharing Mr. Young’s own residence; and “‘Catniping’ the Wild Cats,” telling of Mr. Young’s unusual experiences with Tappan Gregory in intriguing bobcat and puma into taking their own photographs in the remote Carmen Mountains of northern Coahuila, Mexico. But it is not only the fact that is to be valued, but the Youngster recording of it—such expressions as, in “The Coyote Marches On”: “In architecture

the coyote is of the Gothic type—all in points; it has a pointed nose, pointed eyes, pointed ears, pointed paws, pointed teeth, and finally a pointed disposition.”

Here too is *The Wolf in North American History*, which likewise is rich in fact and keen in flavor, gathering together not only obscure references in works that only Mr. Young has brought together, but also quoting Browning and Byron, as well as the American, Hamlin Garland, whose wolf verses can long be remembered with appreciation:

“O a shadowy beast is the gaunt gray wolf!
And his feet fall soft on a carpet of spines;
Where the night shuts quick and the winds are cold
He haunts the deeps of the northern pines.”

This is a work that many will value and many will enjoy. Among the heartiest in their expressions of gratitude will be those who have wished that the wolf, as well as its more popular preyed-upon animals, might continue to have a place in the North American living fauna. For, outstanding as he is in his knowledge of wolf hunting and trapping, and in his experience with wolf control (as the extermination efforts are euphemistically designated), Stanley P. Young is among the most earnest of American conservationists who are trying to scheme into land-management programs some provision for perpetuating the wolves.

“Where found today,” Mr. Young believes, the wolf “will survive only to the extent that its habitat remains remote from man’s activities in agriculture and conservation.” But he goes on to say that “certain as this is, it is nevertheless regrettable that such an interesting mammal must, because of its habits

and economic status, be crowded into a small remnant of . . . its former domain." And with an obvious sympathy he observes: "At no time in any country, during the centuries this animal has been known to man, has any legal act ever been passed to give any protection whatsoever to it."

In another, similar expression of his interests Mr. Young gives a reasoning hope for a wolf preservation effort that is being more and more widely supported. "Doggedly hunted for centuries by every known means at man's disposal, always with its extirpation as the objective, the wolves are, nevertheless, biologically and historically speaking, one of the most interesting groups of all the mammals. It is to be hoped, therefore, that they will never cease to be a part of our North American fauna. It is felt that their survival will always be possible for there remain in North America large areas in which wolves can live in no direct conflict with men, and where their presence may be tolerated."

Nor is it only in generalities and in books that Stanley P. Young has been advocating this survival. He has been outspoken in his defense of the National Park Service's efforts to permit the wolf to share the sanctuary of Mt. McKinley National Park, for example, and has been vigorous in opposing, in any way that he can, the attempts of certain sheep hunters to obtain Federal legislation that would force the National Park Service to abrogate its wolf-tolerant policies.

Who, thirty years ago, seeing a Government wolf-hunter being rescued from a band of Pancho Villa's raiders would have thought that this trapper, who so zealously had followed a wolf trail that he found himself across the border in Mexican jeopardy, would a generation later be so earnestly pleading for wolf perpetuation? And who would have predicted for this rough and ready predator-pursuer the laurels of authorship that he is now wearing? Who among conservationists is not pleased to be sharing with this predator expert the least popular of wildlife perpetuation efforts? And who among readers is not thankful—and hopeful—that Stanley P. Young's flair for the written word will become a mounting enthusiasm?

The Puma: Mysterious American Cat. By Stanley P. Young and Edward A. Goldman. Washington, D. C.: American Wildlife Institute. 1946. xvi + 358 pp., with frontispiece in color by Walter A. Weber, 161 photographs on 94 plates (including 102 skull photographs), 6 text figures (including 1 drawing by Weber), bibliography, and index. \$4.

Sketches of American Wildlife. By Stanley P. Young. Baltimore, Md.: Monumental Press. 1946. xii + 143 pp., with 55 text photographs, 2 text maps, and index. \$3.

The Wolf in North American History. By Stanley P. Young. Caldwell, Idaho: Caxton Printers. 1946. 149 pp., with 49 photographs, 4 text maps, and index. \$3.50.

North American Mammals

Mammals of North America. By Victor H. Cahalane. New York. 1947. The Macmillan Company. 682 pages. Illustrated by Francis L. Jaques. \$7.50.

In this volume we find the happiest combination of popular and often humorous text and scientific fact, making it at once a book for reading and for reference. Victor Cahalane is chief biologist of the National Park Service and an accomplished writer and scientist. As author of *Meeting the Mammals*, and co-author of *Fading Trails*, he has justified these descriptions beyond doubt. Now comes this book, which will take its place as a standard text that anyone interested in American wildlife will wish to have, and that every library in the country must have. It covers all of the North American mammals, and the text is illuminated by 92 attractive and dramatic drawings by Mr. Jaques, outstanding Nature artist. In addition to the material in the descriptive text, the author provides a fine bibliography and list of references for anyone wishing to pursue further the study of any individual species.

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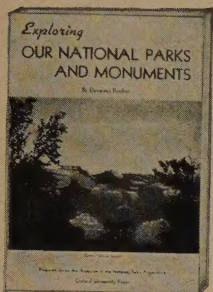
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Biology Textbook

General Biology. By Perry D. Strausbaugh and Bernal R. Weimer. New York. 1947. Second Edition. John Wiley and Sons. 718 pages. Illustrated. \$4.75.

This is a thoroughly revised edition of this textbook, which was first published in 1938. The book has been largely rewritten and many illustrations have been added. Its scope is to present the fundamentals covered in a one-year course in general biology, and particular stress is placed upon the scientific method that has led to important biological discoveries. This last emphasis reflects the fact that changes take place so rapidly that special stress upon principles is needed. The authors are, respectively, professors of botany and biology at West Virginia University and Bethany College, West Virginia.

Cats

Cats in Prose and Verse. Compiled by Nelson Antrim Crawford. New York. 1947. Coward-McCann. 387 pages. Illustrated by 140 drawings by Diana Thorne. \$5.00.

This is an anthology of cat stories, articles and poems that will delight all cat lovers. The list of authors is imposing. In an introductory chapter the compiler asserts that his audience should not be considered as exclusively lovers of cats but that "cats are not a narrow specialty, but a psychologically significant part of the mysterious universe."

German Research

German Research in World War II. By Leslie E. Simon. New York. 1947. John Wiley and Sons. 218 pages. Illustrated. \$4.00.

This book is of particular interest to the physical scientist and to the military man, and is an effective roundup of both German industrial and military research during the past war. It demonstrates the fact that, while much was learned, coordination of that knowledge failed, negating the results of research.

Through the Ages

Life Through the Ages. By R. Will Burnett. Stanford University, California. 1947. Stanford University Press. 48 pages. Illustrated. \$1.00.

This booklet is one in the Standard Visual Science Series, published in cooperation with the Palo Alto Junior Museum and presenting a visual introduction to the story of change in living things. Starting with the Cambrian Era, concise text and effective picture give one a comprehensive basic story of change, ending with pictures of the want, waste and war that man has now achieved as he has "refined" his civilization.

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Long before there was any thought of Social Security or of pensions by most companies, the Bell System instituted a Pension Plan for its employees. The plan went into effect in 1913.

The Bell System Pension Plan was not only one of the first pension plans but it has continued to be one

of the best for employees. The full cost is paid by the Company. The employee is not called upon to contribute anything.

16,967 Bell System employees (10,769 men and 6,198 women) were receiving pensions at the end of 1946.

The Pension Plan is part of a comprehensive Benefit Plan that also covers sickness, accident, disability and death payments. These were paid to more than 110,000 employees and their dependents in

1946. During that year, one Bell System employee in every seven benefited directly from the sickness provisions alone.

All of this is in the interest of the public as well as telephone employees. Because for you to have good service we must have good people to give it to you.

These Pension and Benefit Plans are part of the Bell Telephone Company's responsibility as a good employer and a good citizen in every community in which it operates.

BELL TELEPHONE SYSTEM



Contents Noted

THESE seem to be days when the newspapers print pictures of girls in bathing suits, broad ribbons draped tastefully, identifying the lassie as "Miss Okmulgee," "Miss Mauch Chunk," or as otherwise representative of some metropolis, East or West. So we could not resist the picture that was conjured up by release of the 1948 All-America Rose Selections. We could imagine Diamond Jubilee, Nocturne, San Fernando and Taffeta, all hybrid teas, and Pinkie, a floribunda, mincing before the National Rose Jury as they carried off the honors for the year. High Noon, a climber (trellis-wise not socially), won only sectional honors, since her beauty apparently is only to be savored on the more clement Pacific Coast, and in Southern and South Atlantic States. More severe tests are applied to the rose entrants than to the beauties of the beauty pageants, for fragrance, disease resistance, color, habit, substance, flower form and length and strength of stems are criteria. But, of course, these rose winners must provide their beauty and fragrance year after year, while the Miss Americas reign for but a twelve-month.



AS A YOUNGSTER we were often described as "always having his head in a book." While in school we worked a couple of hours a day in the public library, putting returned books back where they belonged according to the cabalistic markings on their spines. We have always loved books, and have been disturbed to see the movies, radio and "comics" take their place with too many youngsters. Indeed, we know of many families whose children never read a book, beyond those they *must* read for school. This is both sad and dangerous, and it gives point to the slogan "Books for the World of Tomorrow," selected as the keynote for the observance of Children's Book Week from November 16 to 22. This week is sponsored by the Children's Book Council, a non-profit, public-service organization, with headquarters at 62 West 45th Street, New York 19, N. Y. The Council has an excellent poster and a free manual for a Book Week project. Let us give books back to our youngsters if, indeed, we want a world tomorrow.



YOGURT, we understand from the public prints, is enjoying much favor among athletes, who seem to find in it the inspiration for home runs, end runs and marathon runs. Snooping about, we find that Yogurt is a milk food of custard-like consistency, likened by one commentator to junket. (As an old junket-hater from way back, we recoiled a bit at this.) However, Yogurt has long been a staple with peoples of the Balkans, who seem to live longer, pro rata, than people elsewhere. This, of course, is true unless a bullet cuts them down, and, indeed, this substance may have something to do with the chronic war-like tendencies of the Balkan male. History records that Ghengis Khan fed the stuff to his soldiers; Abraham ate it, according to the *Bible*; Kemal Pasha nurtured his minions on it when he fought his war against the Greeks in 1920. Professor Ely Metchnikoff of the Pasteur Institute in Paris gave Yogurt careful study, finding in it the source of a changed intestinal flora that blooms in increased intestinal fortitude. So it now appears that a flagon a day of what is known as Yogurt Master will do wonders for you. Look at the New York Yankees! Some of them are reported to be on a Yogurt ration, and they were not even picked for the first division this year. We had thought it was Bucky Harris' doings.



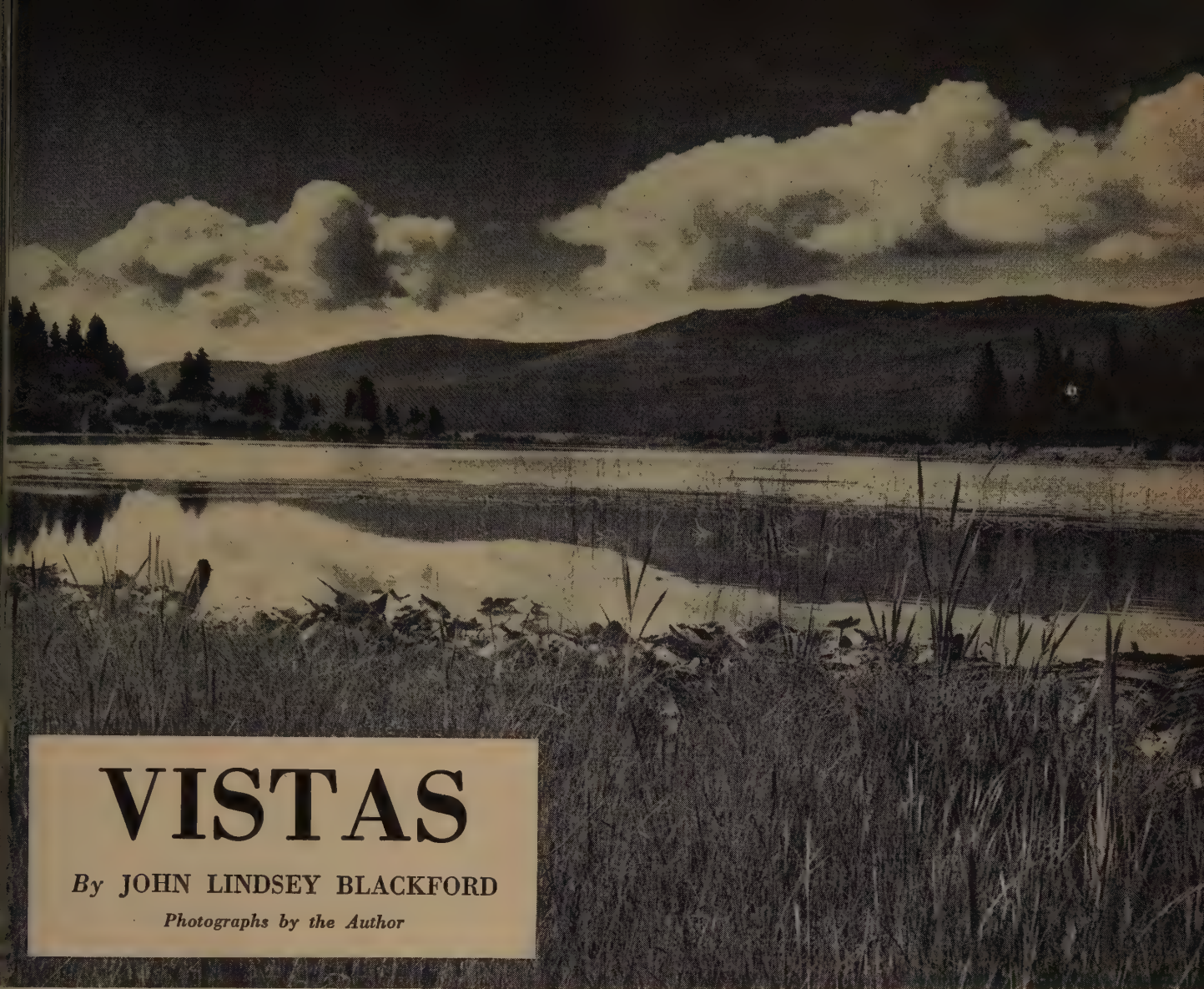
IN all of the publicity with respect to the final establishment of the new Everglades National Park we failed to discover the name of Ernest Francis Coe. This, we gather, was because he was uncompromising in his stand for the originally designated larger area projected for the Park. Uncompromising or not, Mr. Coe, who originated the idea for the Park, fought for it for years at great personal sacrifice, and forced the action that brought final achievement, should be continually recognized and applauded. We were, therefore, happy to see a fine story in the August 9 *Saturday Evening Post* entitled "Papa of the Everglades National Park." Ernest Francis Coe was the sire described.

TO us Mrs. C. N. Edge's 1946-7 annual report of the Hawk Mountain Sanctuary Association is an inspiring document. It is the story of a real conservation project that has enjoyed success because it is sound and because it has come as far as it has through devotion and sacrifice. Much remains to be done to make the facilities at the Sanctuary equal to the educational and inspirational demand and need. Send a dime to Mrs. Edge at 767 Lexington Avenue, New York 21, New York, for "Peace at Hawk Mountain Sanctuary," then do what you can to help in this fine work.

R. W. W.



In recollection, the wilderness and its beauty again
are ours, for memory brings back such scenes as this
of the Tetons across Jackson Lake, Wyoming



VISTAS

By JOHN LINDSEY BLACKFORD

Photographs by the Author

VISTAS of yesteryear—viewed down the magic aisles of memory, glimpsed between the portals of the past—they are the treasured scenes that come back to us of wilderness, woodland, and prairie. Mists of forgetfulness disperse when we recall some mysterious forest shade. Twilight curtains of remembrance part as we picture again a mighty alpine crest. In recollection, the wilderness and its beauty are ours, riches from which we may never be parted.

A row of aspens stands slender, white, nudist-like in the dusk; a streamlet swirls in dark, glassy pools slipping from one to another over rusty-red rocks; a snow-capped range, belted by clouds, is carmined by the alpine glow; and yet, although the light fails, although the stream vanishes, or the glow fades, these scenes, these vistas, are ours always, and our thoughts linger there still.

I recall a lakelet, a far cerulean lagoon. Buoyant lily pads crowd the shimmering surface. Here they bridge across to the farther shallows; there they recede, barely separating the sedges from open water. Along their green, leaf-scalloped border tall, wav-

ing reeds margin the shore.

Black terns hover above, "I recall a lakelet, a dipping and crying. A far cerulean lagoon." belted kingfisher rattles to his swaying perch on a crooked limb that rises from a sunken log. Over the rippling blue, swallows flash and circle. The air stirs with warm breath. Midsummer claims the lagoon, and heat waves dance against the green hills. Yet one feels unceasingly refreshed amid that verdant, languorous beauty. Even with the memory the spirit revives.

Perhaps it is the charm of open fields that is before our eyes. The brown sweep of unfenced plain-land comes to us now. Bitterroot is just passing from bloom. There are limitless reaches of daisy fleabane, and, amongst it, owl's clover. Wild buckwheat and gaillardia are there, and silky phacelia's pale blue flowers. Silver-green, the arrow-like leaves of balsam root cover a low rise of the land. Bluebells, whose swinging chimes ring only for elfin ears, sway in the rippling breeze that caresses the fields of fleabane. Beyond, distantly, lie the tawny hills. It is the end

of June, but for us the beginning of treasured recollection.

How eagerly our thoughts return to the verdant vistas of the forest. Turn a page of memory and a stream curves between a winding willow border; meadows bound it next in turn; while "islanded" darkly, or walling the vale on either hand, spear-pointed spruces tower among spired alpine fir.

In that sylvan solitude, before plunging recklessly from its remote divide, the stream grows sluggish, dammed by beavers. A newly barked aspen log sinks against the silted dam in dull green water. Willows follow old beaver canals into the sedges. A roguish yellowthroat warns from the shrubbery; and dreamily, on this dreamy day, is heard the "weep-heer" of the alder flycatcher.

The creek, we recall distinctly, is an avenue of lighter green curving away between the dark, cathedral-like spruce and cedar. Unforgettable, this is the true, unspoiled wilderness in most poignant mood.

Down the aisles that memory opens, a lakeland picture remains to haunt me. Many a scene becomes enchanting in retrospect; this was surpassingly beautiful

then as well. Far across its mirrored, pellucid water the fringing aspens shimmered silvery-green, the shining white boles reflecting sylph-like images. Under the lake willows bent between thinning poplars and the shore, while a rolling field of emerald swept down at the break in their ranks to the rippleless margin. Lofty in the virescent background, cottonwood rimmed the depression in the hills—forested hills that rose in a mighty backdrop, steep-pitched again to the blue.

Swallow terns circled over the water, crying, weaving, dipping, rising, moving away; returning, hundreds together. Surely this was dreamland, or fantasy.

How many secrets prairie hills hold we shall never know. Each little ravine, each canyon, each rift in the rimrock claims attractions all its own. Juniper and limber pine verdure the jointed, weathered face of the bluffs. They cling to cliffs, and grow in skeletal soil among the fallen rock masses. Prickly pear ascends from beside a dry wash that gashes the prairie

and creeps upward amid the red-leaved
lent pines and cedars. A canyon wren and her brood are glimpsed like dusky mice, stealing among the heaped and tumbled boulders.

"We picture again a mighty alpine crest." Mount Fay in the Canadian Rockies of Alberta.





"The brown sweep of unfenced plainsland comes to us now."

and-winged grasshoppers flutter away in uneven flight,
spily rendering mechanized ditties.

The wavering heat of midday becomes oppressive;
t there is an elixir in the coolness of morning in the
airie hills, and there the purple nights are balmy
d star-strewn. No tarrying in the desert borderlands,
venturing in weathered canyons or juniper-clad
vines but leaves some talisman, some haunting mem-
y of beauty that pursues us always.

Possibly it is a scene of longer association that holds
while we gaze late into the dying embers on the
earth. A remembrance by which commonplace
auty captures not only the eye, but, passing deeper,
iches the heart. A lake before our cabin is such a
e. There mists trail again in the foothill valleys;
ter smoke creeps across the lake's still, steely sur-

face, its gray currents eddying, shifting, lifting in filmy
wraiths. Again the sorcery of moonlight transforms
this scene we know so well, or autumn garbs its hills
with scattered gold.

Perhaps the picture may be some silver-clad aisle
of the winter woodland when the gray-white pall of
a storm has lifted. Ragged clouds are clearing away,
and we discover the valley arrayed in scintillant vest-
ments. Now we stand beneath silvery hemlock and
ermine-robed cedar, conscious of the miracled stillness
of the white forest.

These are the recollections of the wild that become
part of us, and from which we never part. Vistas—
they are the picture books of memory, the avenues
down which the enduring past travels on wings of
thought to become the reverie of present happy hours.

Toad Song

By FRANK WALLACE

You praise a linnet's song
And I the toad's;
They differ less in aim
And moods than modes.

In rain we love a song,
And birds are still;
But toads in happy frame
Lift me athrill.

What matter if a song
By timbre's test
Be this or that, I claim
The boldest, best.

Saucy, Bluejay Tyrant

By PAUL H. FLUCK

THERE was a time when my home was a quiet place. There was no weird screaming, and peanuts did not drop off the tops of doors to hit me on the head. My shirts could still be buttoned, and ladies could confidently wear hairpins. Those days are gone, for today a tyrant rules our household. Saucy, the bluejay, runs the place.

Like all dictatorships, this one began insidiously. Saucy arrived, tiny, scared and innocent, in a cracker box. She had been deserted by her parents; left to face the world without a stitch of clothing or any inheritance. The first arrogant look that she gave me should have warned me. Perhaps I should have fed her to the cat, whose hungry eyes never left the little thing, until I chased him under the stove. But like all tyranny, many of those who are subjected to it dote on it. And, so, we love Saucy.

If you have never had a bluejay for a pet, this article should warn you—never, not even in a lifetime of a thousand years, even think about the idea. You cannot afford the overhead; your home will be pulled down a piece at a time; soon your neighbors will think that you have lost your sanity, or that you have taken to beating your wife.

Rearing a baby bluejay was more difficult in practice than in fact. We tried strawberries on a string, and milk with a medicine dropper, but when we had despaired of ever getting a milligram of nourishment into Saucy, she would reach for the biggest piece of bread she saw, or a chunk of soap, and swallow it without the slightest trouble. She seemed to thrive on anything. Soon her baby feathers gave way to a magnificent mantle of iridescent blue, interspersed with white spangles. Her tail grew slowly, but it grew. Then Saucy began to develop her one and only weapon, her bill. This is her weapon of destruction, her means of acquiring every single thing she wants to steal. Dollar bills—even tens and twenties—have been snatched from hands that held them tightly; watches and rings have disappeared, to be found behind the piano, or to be trampled under the rug, where they were hidden. But that bill was to be the source of Saucy's troubles, too.

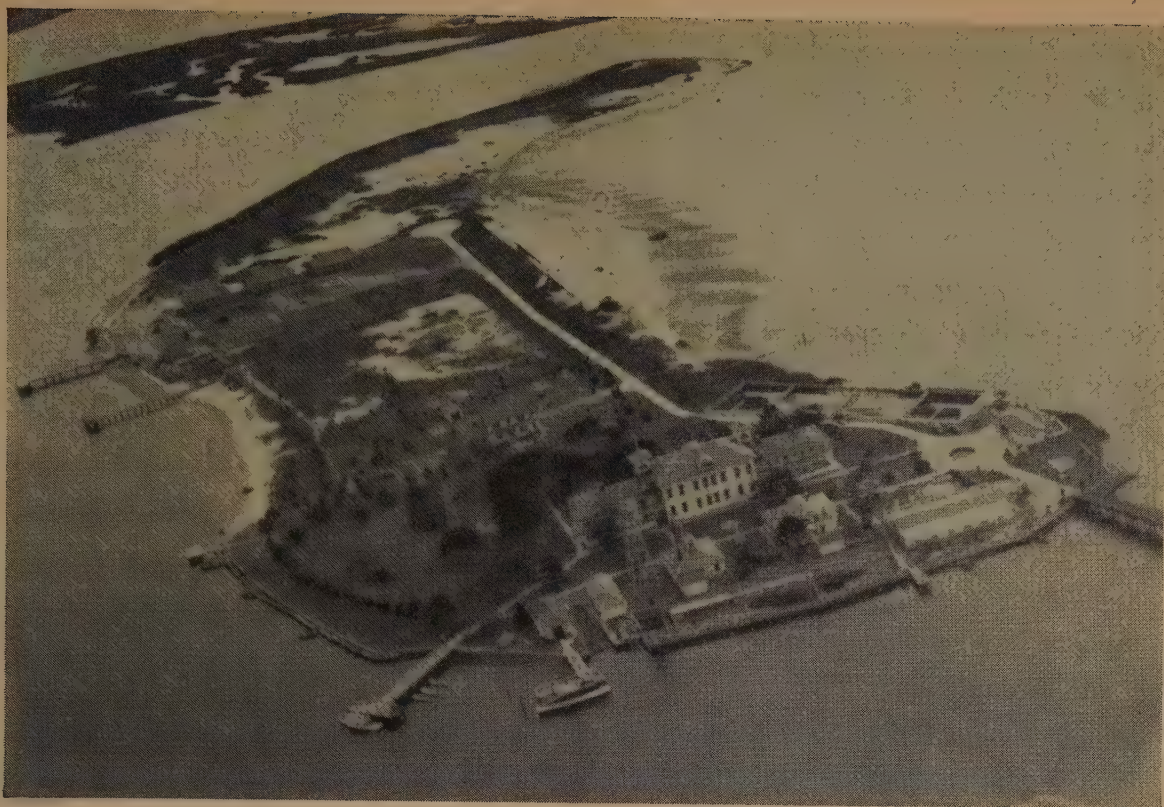
One day the washing machine was running, singing its grinding song. This was Saucy's favorite day, wash day. She flew from spigot to spigot. She grabbed the clothes pins, and worked industriously on every button to test its attachment to the shirt. Each time a button came off, she would fly to hide it. We find buttons in the sugar bowl, or under the band of a hat,



as regularly as we find them in the button box. The Saucy thought she had found out what was singing that grinding song in the washing machine. No matter how hard she whistled, she could never quite out-whistle that contraption. So, apparently deciding her enemy lived in the motor, she tried to tear him loose. Snap, and the revolving part had broken her bill almost entirely off her face. Instantly rescued, major surgery was indicated, and the bill had to be amputated close to the bird's face.

I had intended to liberate her in another week or two, but here she was, a helpless, crippled bird. No other fate but certain starvation faced her in Nature's domain. So, Saucy had to be fed a soft diet in a dozen different ways. Hours were spent in helping her get enough nourishment to keep the feeble flame of life aglow. She became a spoiled baby during the year it took her bill to grow. Now she must have attention or she will scream; she must be rewarded well for everything she does.

It was about this time that I discovered that Saucy liked Pinky, the cat. She would stay close to him and perch near him whenever she could. She would hop down the hall after him, or fly ahead of him wherever he went. The cat, in turn, has shown only genuine affection for the bird, and no interest at all in the calories she contained. Now, with a brand new bill, longer and cruelly curved, Saucy likes to yank the cat's tail, or pull his ears—affections accepted with affection, rather than as an (Continued on page 44)



U. S. FISH AND WILDLIFE SERVICE PHOTOGRAPH BY DR. H. F. PRYTHERCH

An aerial view of "Terrapin Town," more accurately known as the United States Fishery Biological Station at Beaufort, North Carolina.

"Terrapin Town"

By EDNA N. SATER

HUSKY freight handlers at the railroad station in a small town in North Carolina one sultry May morning were being particularly gentle with the shipping crates they were stowing aboard an express car of the train puffing impatiently to be on its way. The boxes, such as baby chicks travel in, were marked, "Handle with care. Live animals."

Inside these crates were 500 squirming little animals measuring an inch and a half in length. A layer of damp bog moss covered the bottom of the boxes to provide moisture and to prevent scratching and jarring on their long journey—from North Carolina to California.

Not baby chicks, however, but young diamond-back terrapins, 10 months old, along with a few adults, were being shipped across the country to California from "Terrapin Town" in Beaufort, N. C. Because this species does not occur on the Pacific Coast, the Federal Government and the State of California were cooperating in an effort to give that region its share of this prized terrapin, which has always been the exclusive possession of the East Coast. On May 13 and May 30, 1943, the terrapins from Beaufort were released in San Francisco Bay under the supervision of the California Division of Fish and Game. These

plantings marked the first attempt to naturalize the diamond-back on the West Coast.

Whether or not connoisseurs of good food in the West will be able to produce a terrapin stew à la California within a few years depends on what kind of reception the little strangers from "Terrapin Town" received when they landed in California waters. If the famed California welcome sign was out, and the migrants found no shortage of living quarters similar to their natural habitat on the East Coast, undoubtedly they will survive and multiply, and California will have made another conquest. It is too soon, however, to determine the success of this transplant because terrapins are slow-growing animals. A minimum of six or seven years is required before they reach the adult stage and are able to produce young. Many take eight to ten years to reach this stage in life.

The terrapins shipped to California were produced at the terrapin hatchery at Beaufort, N. C., operated by the U. S. Fish and Wildlife Service. This hatchery, known far and wide as "Terrapin Town", has reared more than 241,000 young terrapins since 1910 for experimental and breeding purposes, and for the restocking of depleted coastal areas from Chesapeake



NORTH CAROLINA STATE NEWS BUREAU PHOTOGRAPH

Terrapins in breeding pen come in a hurry when Cap'n Hatsel whacks a tin fish bucket with a shovel. Chopped fish is served three times a week to the adult animals at the Beaufort terrapin farm.

Bay to Louisiana. The famed diamond-back terrapin might long ago have joined the list of extinct animals had not methods of artificial propagation been developed and tried at Beaufort.

The diamond-back terrapin, *Malaclemmys centrata*, is a turtle that inhabits shallow salt- and brackish-water bays, estuaries, and swamps along the Atlantic coast from Cape Cod to Yucatan. Five species are recognized in the United States. Scarcity, brought on by years of lax laws and ruthless hunters, coupled with unusual market demand, has put the terrapin into the class of high-priced luxury foods. Around 50,000 pounds are captured annually today, of which a small portion is canned and the rest sold fresh.

Before 1900 diamond-back terrapins were common to abundant from Chesapeake Bay southward, and could be bought for three cents a pound. Then came the glamorous publicity of the first decades of the 20th century when terrapin à la Maryland was served at banquets for Washington statesmen, at meetings of international gourmets, and at dinners given by "Diamond Jim" Brady for stage celebrities such as Lillian Russell. By 1920 the diamond-back had been publicized almost into extinction.

With the passage of the 18th Amendment to the Constitution, many persons felt that the diamond-back terrapin would become almost worthless because the preparation of this delicious and costly stew required the use of wine and cream. This was not the case, however. In 1923 first-class Carolina terrapins of six inches sold for \$30 a dozen, with larger ones bringing more, in markets on the North Carolina coast. In 1926 it was reported that in Boston diamond-backs retailed at \$1 per inch

of the length of the lower shell. Thus, a six-inch terrapin would sell for \$6, or a dozen would bring \$72, or even more.

These fancy prices played havoc with the natural supply of terrapins because the demand for them led to such persistent overfishing that a marked decline in their numbers occurred. In 1923 North Carolinians became so alarmed over the growing scarcity that they ordered a closed season on terrapin fishing for five years to give the animals a chance to reestablish themselves.

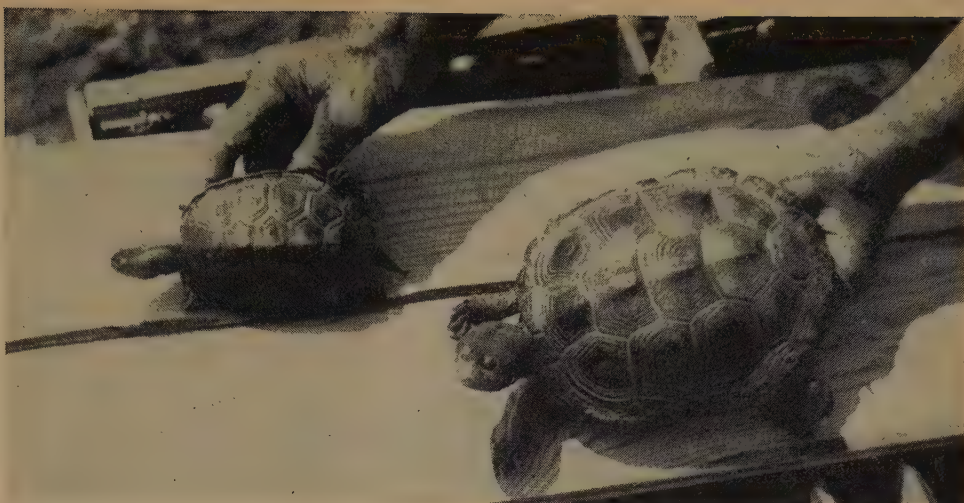
As early as 1902, however, the U. S. Fish Commission had interested itself in the plight of the vanishing terrapin and begun a study of the life history of diamond-backs in order to discover a method for their artificial cultivation. By 1909, when experiments had demonstrated that artificial propagation of the terrapin was feasible, this work was started at the Beaufort Station, and thus "Terrapin Town" was born. The original brood stock consisted of 44 females and 12 males, and 12 young were hatched that first year. In 1914 a brood stock of 39 females and 18 males had

U. S. FISH AND WILDLIFE SERVICE PHOTOGRAPH



Cap'n Hatsel, who has worked with the terrapins from 1902 to 1947, when he retired at 69, releases some of the baby terrapins, ten months old, in a salt marsh area of North Carolina to restock the region and restore a native animal.

the world of the terrapin there is no doubt as to which is the mightier. Here we have a male and a female. Females are the only ones that go to market as a rule, since they attain the salable length of six inches.



U. S. FISH AND WILDLIFE SERVICE PHOTOGRAPH

produced 836 young, with the percentage of eggs hatched being 90.6.

Since then experiments conducted by Dr. Samuel Hildebrand and Dr. Herbert F. Prytherch, present director of the Beaufort laboratory, have considerably stepped up productivity on the part of the breeding stock. Now the hatchery is producing from 10,000 to nearly 17,000 young each year, with a brood stock of about 600 males and 2000 females. During the summer breeding season of 1946, a total hatch of 12,845 young was obtained in spite of damaging rainfall during the incubation period.

Most of the credit for the successful propagation of the terrapin, according to Dr. Prytherch, is due to the interest and painstaking work of Captain Charles Hatsel, terrapin culturist and foreman since 1902. The care of the young and adult terrapin, the actual work of carrying on the experiments, and the keeping of the original records were the responsibility of Captain Hatsel until his retirement on his 69th birthday in February, 1947, after 45 years of service devoted to the building of "Terrapin Town" and its tenants.

N. C. CONSERVATION DEPARTMENT PHOTOGRAPH



The sights of "Terrapin Town" attract more than 10,000 visitors annually to the Beaufort station. Regular excursion groups of students from high schools and colleges, often from distant points, visit the station to obtain first-hand information on the life history of terrapins, as well as to view the aquarium, museum room, and the six outdoor exhibit pools where large sea turtles, sharks, stingrays, and alligators are displayed.

The U. S. Fishery Biological Laboratory, as the station is officially known, is reached by Route 70, continuing east from Morehead City, N. C., but turning right before Beaufort, as indicated by a road sign. The station is situated on Pivers Island, which lies within Beaufort Harbor about 1 mile from Beaufort Inlet. It is separated from the mainland and the town of Beaufort by a channel about 150 yards wide. The island is connected with the highway by a bridge and causeway. In front of the laboratory may be seen breaking seas of the Atlantic Ocean, while to the east and west is an intricate system of waterways, islands, marshes, and tidal flats lying at the mouth of the two rivers and two sounds connected with Beaufort Inlet.

The Station's main attraction for visitors—the concrete breeding pens, bedded with sand and used for the propagation of the young terrapins—are arranged along the shores of the island and so located that they are flushed by every tide. Clean water is highly essential in terrapin rearing. The sides of the pens are of smooth concrete to keep these agile animals from escaping.

Terrapin activities are at their height during the summer months when the animals are

A female terrapin deposits her eggs in a hole dug in the sand. She digs a jug-shaped hole with her hind feet, lays from seven to nine eggs, carefully replaces the sand and packs it down, crawls over the spot to conceal it and departs.

not hibernating and one of the highlights of a visit to "Terrapin Town" is watching the animals at feeding time. Diamond-backs learn quickly to associate certain sounds with the advent of food, and when the station attendant whacks the tin fish bucket with a shovel, the terrapins in the breeding pens come a-running. The staple food is scrap fish, with an occasional feeding of blue crabs or fiddlers.

As soon as the weather grows warm, the egg-laying season starts and continues for several weeks. At Beaufort the earliest date on which laying has been observed is May 6 and the latest date July 31. Persons fortunate enough to be there during the right season will be able to take a peek into the private life of an "expectant" terrapin.

When the female terrapin gets ready to deposit her eggs, she selects a suitable location on the sand bed and prepares a "nest" by scooping out a jug-shaped hole with her hind feet. This hole will be about five inches deep and two and one-half or three and one-half inches across the widest part. When the digging job is completed to her taste, she backs into the hole and drops her eggs. Then she carefully replaces the sand, packs it down, conceals the spot by crawling back and forth over it, and departs. Motherhood, for her, is over, for there is no evidence to show that she ever revisits the spot or takes the least bit of interest in her offspring after they are hatched.

The usual number of eggs found in a nest is from seven to nine and they will hatch in about 65 days by the heat of the sun. Under proper care and with healthy stock, the percentage of hatched eggs runs about 85 to 90 percent. While a female may lay only once during a season, it is not unusual for her to lay three or four times. The maximum egg production seems to occur when a terrapin is about 25 years of age. But Dr. Prytherch will tell you that the oldest female at "Terrapin Town"—estimated to be more than 50 years old—produces as many eggs as females less than a third that age.

After hatching in August or September, the young are collected from the egg beds and transferred to the terrapin rearing house. In this building some 15,000 terrapins are fed and hibernated from October to June.

Various experiments carried on at the Beaufort laboratory have shown the advantage of placing the young in a heated house, or small hothouse, during their first winter instead of permitting them to hibernate. This method has reduced the death rate and promoted growth. In the rearing house the ani-

Cap'n Hatsel with some of the adult terrapins that were shipped to California for the restocking experiment.

U. S. FISH AND WILDLIFE SERVICE PHOTOGRAPH



imals are kept in square wooden tanks tilted at such an angle that the terrapins can crawl out of the water when they so desire. The heat prevents complete hibernation and the young terrapins that feed throughout their first winter show a gain of about a year's growth. In terrapins that are fed for one or two winters, egg production generally begins in the fifth or sixth year. In hibernating terrapins it rarely occurs before the seventh year.

The terrapins are held in the hothouse in the spring until all danger of cold nights is past. Then they are placed in a small outside pen, prepared especially for them, and feeding is continued as in the house. The young remain at Beaufort for 11 months after hatching and then the distribution work begins. This is usually carried on with the cooperation of State game and fish departments along the Atlantic coast. In 1945, for example, 11,000 terrapins were distributed as follows: 3500 in Virginia waters, 2750 in South Carolina waters, 3000 in North Carolina, and 1750 in Georgia.

During the last world war several hundred of the eggs, embryos, and newly hatched terrapins were used for medical studies at the National Institute of Health at Bethesda, Md., by their Division of Infectious Diseases. This material was employed in investigation of certain infectious diseases of military importance in which the cultivation of the infectious agent was being attempted in fertile reptilian eggs because of their incubation at lower temperatures than are feasible in avian eggs.

In connection with the distribution work, Dr. Prytherch enjoys telling this story. "One time, on instructions from the State Depart- (Continued on page 440)



Mums When You Want Them

By EDWIN D. NEFF

HERE is big news for chrysanthemum fans, whether you grow them or just wear them.

An amazingly ingenious trick discovered by Department of Agriculture wizards at Beltsville seems likely to revolutionize the 'mum industry; save scientists years of genetic research; and give chrysanthemum lovers their favorite blossoms by the armload just about any time of year.

This fairyland magic actually is nothing more nor less than the use of a few minutes of electric light at the witching hour on greenhouse plants. Oddly enough, midnight lighting—no other time works as well—delays the plants' blooms. This is just the opposite result of the old trick of draping the flowers with black cloth to shorten the day, and produce early blossoming. It seems a 'mum can be easily tricked.

No one knows yet why the results are what they are. But, perhaps, Mrs. X loves the charming white blossoms of Little America chrysanthemums. Mr. X buys her a dozen or two for their wedding anniversary. A week or so later Mrs. X decides to decorate her parlor with the same blossom. Too bad, the florist tells her, Little America has bloomed and vanished. Or, perhaps, Orchid Queen, the coeds' football favorite, a big, showy blossom with color of gold, fills the stadium for the early football games, but cannot be had for the big Thanksgiving game. By the shameful trick of waking Little America and Orchid Queen for a few moments in the middle of the night, a sly florist could guarantee both these customers what they wanted at almost any time they wanted it. The same is true for the lovely pink blooms of Masterpiece, and



What midnight lighting does to Cordova 'mums. From left to right, the first plant received no lighting and was allowed to bloom normally on December 3. Second plant received lighting from August 1 to September 25; third plant from August 1 to October 9; fourth from August 1 to October 23. The third and fourth plants bloomed ten weeks after the lighting was stopped. Note short stems on the first plant, which received no light, and the long stems on the third and fourth plants.

dozens of other fashionable and favorite 'mums.

This is far simpler than tinkering with the 'mums' complicated chromosome pattern to try to breed a perfect flower that blooms on a given date. Instead, it is now possible to select an ideal variety and make it bloom to order.

As early as 1928, Department of Agriculture men pointed out that the flowering season of 'mums varies according to daily exposure to light. Blossoming begins in the fall when the days grow short. Since short days mean long nights, the cue seems to be the amount of darkness to which the plants are subject before the buds appear. Early experiment led to the delay of flowering by the use of lights at the end of the day, artificially extending normal daylight to fifteen hours or more. The results were not startling, but enough to hint to the experts they were on the trail of something.

Then two Department of Agriculture scientists, H. A. Borthwick and M. W. Parker, working with soybean blossoms, began using lights at different times of night. They found the midnight lighting most effectively delayed the soybean blossoms. To the Beltsville chrysanthemum men, the news from the greenhouse next door was a page-one flash. Would the haughty chrysanthemum react as did the humble bean?

To find out, Dr. Neil W. Stuart, helped by Dr. S. L. Emsweller, both of the Department's Bureau of Plant Industry, Soils and Agricultural Engineering, selected 500 rooted cuttings of Jewell, Red Princeton, Cordova and December Gold, all provided by a commercial firm. The cuttings were received in May, and the plants shifted to eight-inch pots in July. These were placed on eight equal sections of benches, sixty

pots of each variety to a section. Five of the eight sections were lighted by electric bulbs spaced four feet apart and suspended four feet above the benches. The lights were equipped with twelve-inch reflectors. All lights were controlled by automatic time switches, and each of the lighted sections was screened on the sides and ends at night with black curtains.

The three remaining sections were unlighted to serve as controls. The five sections were lighted every night from August 1 to December 15 as follows: 1. Ten minutes at midnight. 2. Thirty minutes at midnight. 3. Five minutes at two-hour intervals, 8 p. m. and 10 p. m., midnight, 2, 4 and 6 a. m., a total of 30 minutes. 4. Sixty minutes at midnight.

The fifth section was divided into three parts receiving sixty minutes of light at midnight from 75, 50 and 25 watt bulbs respectively. Twenty plants of each variety were exposed to each of these light intensities.

Beginning August 14, eight plants of each variety were shifted at two-week intervals from each of the light treatments to the unlighted benches, and replaced with the same number of plants from the unlighted "control" benches. This was done to determine the approximate date when light treatments should be started for best results.

The purpose of the main different light exposure was to determine the ideal lighting period. When buds are delayed from blooming, the plant continues to grow, of course, and the growth goes into weight and height. When excessive light is used to slow down bud development, excessive vegetation results. On the other hand, with Cordova, the unlighted plants bloomed on too-short stems. The lights corrected the

completely and produced a proper bloom and stem. With Jewell, all plants receiving light until August 14, bloomed October 21, regardless of the variation in the nightly light period. Unlighted plants bloomed as normal—October 15. Unlighted Red Princeton plants bloomed November 21, but the lights extended the blooming season through December, January and February, depending on the length of treatment. Unlighted Cordova plants bloomed December 3, but shifting the Cordovas from the light treatments at intervals, produced a continuous series of blooms until March. The December Golds bloomed December 14, when no lights were used, but shifting the plants from the lights after various exposures extended the blooms through January and February.

In all cases, use of light during bud formation damaged the plant by causing it to revert to a vegetative condition. The tests showed that lights should be started at least two weeks before buds are normally visible for the particular variety.

As a result of these experiments, it was decided to try 15 minutes of light, and new tests with 100 plants each of ten commercial varieties were made. These disclosed that the number of days' delay in blooming produced by the lights was related to the normal flowering season of the variety, the later varieties requiring the longer lighting. Again, the use of light during the period when buds were forming caused reversion to vegetation.

Present tests at Beltsville indicate 30 minutes of light with 50 or 60-watt bulbs will prove best when a short delay of a few weeks is desired. The light should begin at least two weeks before the first visible buds.

Dr. Stuart advises selection of vigorous, midseason to late-flowering varieties, discontinuing the lights according to the blooming time desired. In a recent publication, he states: "For varieties normally blooming before November 15, allow nine weeks after the lights are stopped until blooming; for varieties blooming after November 15, allow ten to eleven weeks, and for those blooming in December, 11 to 12 weeks."

Most significantly, Dr. Stuart found "the blooming season of all varieties of chrysanthemums thus far tested has easily been extended for several weeks. This suggests that a grower could select a few choice varieties and flower them over a fairly long interval rather than grow a number of varieties in order to

meet market demands. This is the commercial angle.

To a chrysanthemum man, this statement is a minor miracle—perhaps not so minor. Dr. Emsweller, principal horticulturist at the Bureau, is a specialist in the breeding of 'mums. He believes the light technique will enable commercial growers—and amateur growers with greenhouses—to eliminate the poorer varieties of 'mums by controlling the flowering time of the best types. This is a far, far simpler matter than attempting to breed a high-type chrysanthemum which also blooms late; for the 'mum is an exceedingly complex flower. Technically, it is known as a hexaploid, meaning it normally has six sets of chromosomes, with nine chromosomes to a set for a total of 54. An Easter lily plant has only 24 chromosomes.

To breed a new type of chrysanthemum according to plan is an excruciating task, requiring years of experiment. For example, to produce a late, high-quality bloomer with blossoms of a specific color, it might be necessary to begin with a high-quality early bloomer of that color and cross it with a late bloomer of low quality but with the desired color. Due to the high chromosome number, many different colors might result. Then would follow a period of selective breeding until a desirable plant was secured which could then be rapidly propagated from cutting. If we got what we were after, Dr. Emsweller says, it would be largely due to luck! Commercial growers have been quick to

agree with such a viewpoint.

Already several of the larger growers have adopted the light technique, and in five years most of the others will be on the bandwagon, Dr. Stuart believes.

Of course, genetic research into chrysanthemums is not going to be inactivated. As a matter of fact, it will be made swifter and easier by the new light technique. There are still many genetic problems puzzling the Beltsville 'mum experts, and Dr. Stuart believes the use of lights can actually save them time.

Under the new method, a choice, selected chrysanthemum can be seeded in the winter and allowed to bloom normally in the fall. The plants may then be grown in a greenhouse under lights, speeding the development of the plant, although delaying the blossoms. The process then can be reversed, using the black cloth drapes to speed flowering, producing blossoms in the spring; thus two (Continued on page 442)

An Afternoon in Autumn

By GERHARD FRIEDRICH

The music of the woods is silent now,
And mellow sunlight trickles from the leaves
In many golden drops.
The winter's blasts, the young and lusty spring,
And summer with its joyous days have grown
Into a timeless, calm maturity,
Which is the great fulfilment of this world.

It is a pleasure thus to walk alone
And worship beauty that is quite content
With right of mere existence.
Before the whirling dance of withered leaves
There is a pause, a penetrating stillness,
Holding all simple, rooted, earthly things,
As if in meditation, half-subdued.
And if you watch them with a sober eye,
They fill with secrets of eternal growth
The hollow of your hand.

Lee Passmore, Naturalist and Camera Wizard

By LUCIEN M. LEWIS

SOME assert that work and patience alone are responsible for the onward and upward march of the human race. That statement, however indispensable those two qualities are, is not true. If it were, any plodding electrician could become an Edison or a Steinmetz. The third important factor in man's evolution—perhaps the most important—is genius, that gift to a chosen few in every field of endeavor.

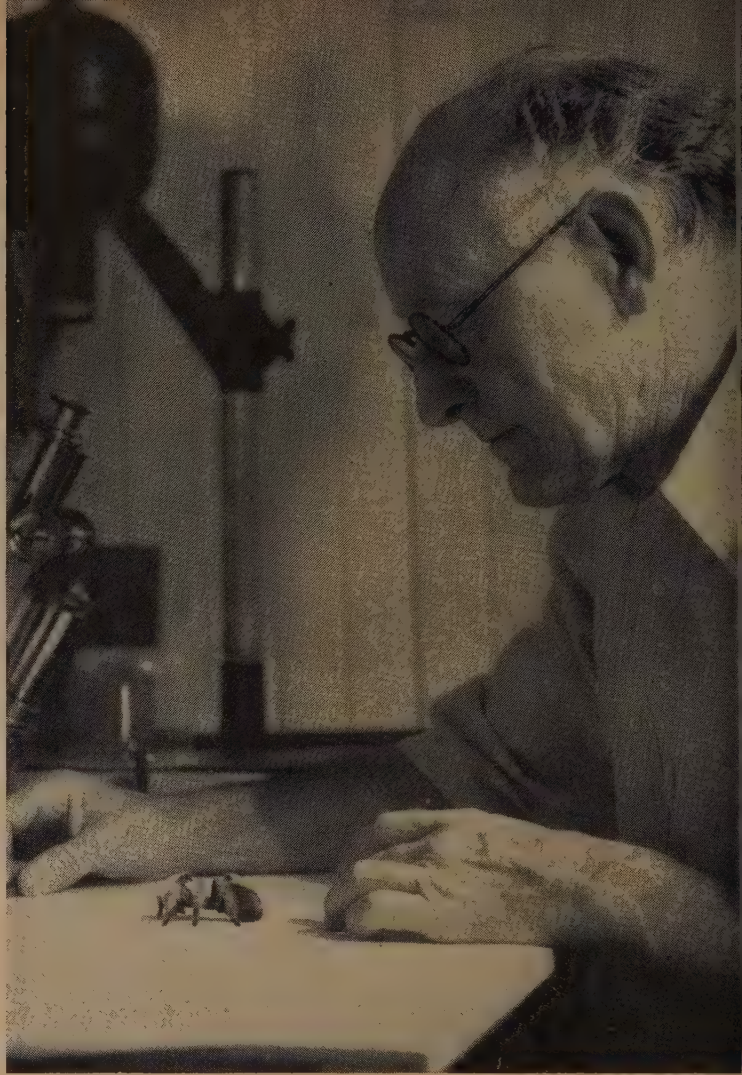
Lee Passmore, San Diego naturalist and photographer, is one of the elect in the field of outdoor photography. In his hands a camera becomes an instrument of wizardry. He turns it upon a desert yucca, and that marvelous plant, pulsing and glowing in kodachrome, comes to life on print or screen. He sights it at a leaf, and a caterpillar stands out like some frightful jungle creature.

Although I had known Lee Passmore by reputation for more than two decades, my personal acquaintance with him is comparatively recent. One mid-summer afternoon I had strolled up a canyon and sought cover in thick underbrush to watch the wildlife about me. I had been seated there for perhaps a half hour, watching the antics of a pair of half-grown cotton-tails, when, glancing across at the opposite canyon wall, I saw a man sitting on a boulder, a pair of binoculars focused upon some object.

Glancing at him at intervals, never once did I see him shift position. I felt sure that he had not seen me, for he was too intent upon the business at hand. The longer I watched him the more curious I became about what had brought him there. A mineralogist, perhaps? But no, he had made no move to study outcroppings. Too, the binoculars were fixed upon one spot.

Finally, as deepening shadows made observation difficult, my man of mystery left the boulder and started down the slope over the trail that led past my hiding place. Waiting until he was within hailing distance, I stepped out and called, "Hello, neighbor! Going my way?"

The man who jerked up with a start was heavy-set, a bit broad of chest, erect and with the fresh coloring of the outdoors in his cheeks. Looking me over appraisingly as he approached me, he smiled and said:



Lee Passmore at his desk studies a live tarantula, into life habits of which he has probed with camera.

"Friend, this canyon belongs to me, unless you are a Nature lover. In that case I might share it with you."

"I should not be here at this hour if I didn't belong to your fraternity," I replied. "But if you'll pardon my inquisitiveness, I'd like to ask if you were watching anything in particular."

"I'm Lee Passmore," he said. "I was . . ."

"Oh, I see." I hastened to grasp his hand. "That explains the mystery. Had a tarantula hawk under observation, I'll bet."

He nodded. "You're right. It was a pepsis wasp, commonly called tarantula hawk."

"You certainly have patience," I observed.

"Patience? That little stunt was nothing. Photographing the metamorphosis of the cyrtid fly parasite from egg to adult required continuous watching of thirty-three days and nights. And in a thirty-month period of spying on the habits of trapdoor spider I was up the greater part of 300 nights. I tiptoed to a position near the nest, set up my camera, spread a blanket and lay in wait, releasing sow bugs at intervals within a few inches of the door. The vibration from the feet of the bug attracted the hungry spider waiting for her prey. When the bug came within

triking distance, the door was suddenly released for a split-second, and in that instant a flashlight exposure was registered on cut-films."

As we walked down the canyon homeward, he began to tell me something of his work and how much it meant to him. In the midst of our conversation he halted abruptly, in the manner of a hunting dog on scenting game. And it was game, his game.

I caught the rank odor of jimson weed, and in another moment its luminous trumpet-like flowers were waving at us through the dusk. Then came the faint noise of whirring wings. Passmore motioned me to follow him. A sphinx moth, treading air like a hummingbird, was hovering over a flower as it thrust its curled, proboscis-like tongue into the heart of the corolla, to suck the nectar hidden there.

"There is a perfect example of what botanists call symbiosis," he whispered. "A flower and an insect each seemingly made for the other. The jimson weed can't pollinate itself, so some insect must carry pollen grains from other jimson blooms. The nectar lies so deep in the tubular corolla that only an insect with a long tongue, such as the sphinx moth's, can reach it. That insect is specially adapted to gather jimson weed pollen and distribute it. Those luminous trumpet-shaped flowers are the one color that shows best at dusk, the moth's feeding hour. Furthermore it gives off an odor peculiarly attractive to the moth. There you have it, flower and insect, each seemingly made for the other, each helpless to reproduce its kind without the other."



That is how I met Lee Passmore. Since that meeting in the canyon, I have visited him as often as his limited time will permit. Although he lives alone in a Nature-lover's paradise, he is never lonely. He is too busy with his studies, and too much in love with life ever to feel alone.

His home is situated near the entrance to Talmage Park and not far from the foothills. It suggests the naturalist owner. There is no planned lawn, no hedges with neatly-trimmed borders, only a wild tangle of plants that grow as they like. There are swaying eucalyptus and cypress, cactus and bamboo, toyon loaded with red berries, aloes and oleander, feathery ferns growing waist high under a pergola. Large floodlights with reflectors brilliantly illuminate the grounds about the house.

Lee was in his front yard when I came upon him lately. Hose in hand, he was thumbing a fine spray about him, above which shone a rainbow. Three ruby-throated hummingbirds darted in and out of the spray, iridescent blurs seeking a dainty bath. Lee's eyes sparkled as he watched those rainbow-tinted streaks of feathered light. Then he saw me, and smiled a greeting as he laid aside the hose.

"Did you see the little beauties sticking out their tiny feet in rainbow spray?" he laughed happily.

As we walked about the spacious grounds we came to his studio. He opened the door and invited me to enter. When my eyes became adjusted to the soft lights of the interior, I saw that here, again, the naturalist is evident. The four walls are covered with photographs of many creatures that walk, fly or swim. Here are stored cameras and lighting that are marvels of ingenuity. Special apparatuses of Passmore's own invention are used to make pictures of his subjects in any position. All are in readiness for instant action.

From a steel cabinet Lee selected a series of kodachrome slides, which, when completed, will illustrate the growth of two species of the yucca family. He told me of his plans for the coming spring, when he will take pictures of some stages he was unable to get the past year. Only a few are required to complete the series.

A slide projector in readiness, and a large, beaded screen in position, assured me that I was about to see some of the work that this man is doing in the interest of science. In rapid succession the yucca, in magical kodachrome, passes through each stage of growth upon the screen—olive-green, dagger-like leaves sprouting forth, followed by arborescent stem, on up through blossom, fruit and final decay at the end of the seeding stage. Fronds appear to tremble and

One of Lee Passmore's splendid pictures of the trapdoor spider, showing it as it sinks its fangs into a luckless sow-bug before taking the prey into the burrow.

flutter, as if lifted by the breeze; creamy-white petals gleam with a satiny softness, change to molten gold under a dark sky as the afternoon sun sends its last beams across the desert; then the "Candle of God" flames in sunset glow. As the yucca suddenly changes from flower to fruit, clusters resembling green cucumbers hang from top branches. A small opening appears in the smooth rind, out of which a scarlet-colored larva emerges and slips to the ground.

Lee Passmore had not copied life, but had reproduced it in color, intensifying it so marvelously that I could not have placed a finger upon the exact spot where background and contours met. He had challenged Nature herself and come out victorious.

Switching on the studio lights and holding up an old seed-pod from which the seeds had fallen, Passmore said: "Here we have another of those never-ending miracles in plant and insect relationship. The female moth—*Tegeticula*, to be exact—gathers pollen from anthers of yucca blossoms and shapes it into a pellet. She then flies to another and inserts her ovipositor into the flower's ovary and lays her eggs among the ovules. Next she thrusts the pollen-ball into the opening, which extends the length of the style. When the egg hatches, the caterpillar feeds on the tender young seeds, which develop along with the larva. When ready to leave the seed pod it bores its way out and escapes to the ground, where it hibernates and completes its metamorphosis, leaving the plant to develop the remaining seed without further molestation."

From the studio my naturalist-friend took me to his study, a large room flooded with sunlight from windows on three sides. And here, again, Nature effects prevail. He showed me his library of scientific works, many of which contain illustrations from his thousands of photographs taken during more than forty years. Not until that visit, when I found his photographs in so many books and magazines, was I aware how high he ranks among scientists. Reserved and unassuming, he shuns publicity and has to be prodded into talking about himself.

"I am in this work because I love it, and for the further reason that it enables me to share my little store of knowledge with those of similar tastes," he said, ignoring my question about its commercial aspects, which are of little concern to naturalists.



One of Lee Passmore's pictures of a South American spider, showing the head parts, eight eyes and the efficient fangs.

While Lee Passmore is known internationally as a naturalist-photographer, his exhaustive study of the California trapdoor spider, and his collection of photographs of that species, is perhaps his most unique contribution to science. He was one of the first to photograph the trapdoor spider in its subterranean nest, showing in detail the manner in which the door is constructed and how she sometimes transplants moss on the lid, making it an ingenious camouflage. Since the trapdoor spider is a nocturnal worker, Lee's observations had to be made mostly at night. His flashlight pictures show the spider hinging the door, and, again, as she lines the burrow with silken web.

Of the many photographs upon the wall, that of the wolf

spider, in Lee's "rogue's gallery," is most likely to attract attention. Hairy as some frightful jungle creature, stealthily watching for prey with its eight baleful eyes, armed with enormous jaws and poisonous fangs, the wolf spider is well named. They are as voracious and murderous as the name indicates. Depending upon their strength, speed, skill and venom, they viciously attack and quite often overcome creatures much larger than themselves.

"Do they snare their victims in their webs?" I asked, noticing the many crafty trap devices shown in some of the pictures. "Rope them, as it were?"

Passmore shook his head, smiled and said: "Not that species. The wolf spider approaches its prey much in the manner of a cat creeping upon a mouse. When within striking distance it springs upon its victim and paralyzes it by injecting venom from two small openings, one situated near the tip of each fang."

"Because spiders and insects prey upon each other, don't get the impression that they are our enemies," he hastened to add. "Most spiders are our friends and each is a part of Nature's plan of holding the necessary balance. Knowing this, upon closer acquaintance, man's fear or loathing usually vanishes."

He gave a whistling call, reached over and opened a paper bag. Out glided a chuckawalla. The large lizard darted up Lee's shirt sleeve and perched contentedly on his shoulder, flicking saucy eyes at me.

"I collected this specimen twelve years ago, on the Arizona desert," he said. "Her diet consists entirely of lettuce." Then, catching my uneasy glance about the room, he added with a (Continued on page 442)

Magnetic Ants

By H. BOWDEN FLETCHER

IN Australia, and only in Australia, there is a species of termite that builds its nest according to the compass. There is nothing rough and ready about the directional instinct of this meridional, or magnetic white ant. The long axis of its nest faces, directly and accurately, north and south, the broad axis east and west. The insect also erects its colony of homes to a preconceived plan, with perfectly oriented rows, surrounding an open space, in which it apparently prohibits any building. Evidently there are special termite building inspectors to police this rule.

The habitat of this one of several species of Australian termites is confined to a narrow, thirty-mile strip of country in the Northern Territory about ten miles south of Darwin. This variety is found nowhere else on this continent, or, in fact, anywhere else in the world, so far as is known. The termites seem to prefer damp, ill-drained soil of dark gray color in country almost devoid of trees. Occasionally they build where there are scattered, dwarfed, native trees, but they never select the higher, red soil coun-



One of the structures of the "magnetic" ants, or termites, built according to the compass. These are on Cemetary Plain, ten miles from Darwin, Australia. At the left, side view of these structures in a well-arranged colony.



try or the open forests not far from their habitat.

The actual nests are usually from ten to twelve feet high, ten feet long, and three and one-half feet through the middle at ground level. The ends are vertical and slightly narrowed towards the apex, which is always serrated, and the actual mounds are just as hard as could be imagined. To the uninitiated they just look and feel like hard, packed mounds of dirt, and anything but a nest. The longer sides are not vertical, and the eastern face is invariably slightly

concave, the western side convex below the middle and concave above. The reason for this peculiarity remains hidden in the instinct of the termite, and the scientist has no explanation to offer.

The reason for the accuracy in building due north and south is still interesting scientists, who originally thought it was to face the prevailing winds. The prevailing winds refuted this argument by coming from the other direction. Then it was suggested it might be to enable the winds to give quick drying after the monsoonal rains, but the winds also corrected this fallacy. The now-accepted theory, although minus any accurate proof, is that the termite seeks to avoid the extreme heat of the summer months in the part in which it lives. This is, to some extent, supported by the location of the actual living galleries, on the outside surfaces only, while the center galleries are filled with cut-up grass and herbage on which (Continued on page 442)

Wandering Kings

By W. L. McATEE

TEN species and subspecies of the kingbird group are recorded from the United States. The common forms, often known as bee birds or bee martins, attract attention by their aggressiveness in defending their nesting territories. Any and all bird intruders are driven away—even those from several (crows) to many (hawks and buzzards) times the size of the doughty home defenders. A large bird is embarrassed, and acts the part, when the smaller and more agile kingbird flies rings about him, screaming, treading, pecking, and even making feathers fly. Its awkward efforts to escape are equalled only by those of a kingbird itself when a bullet-like hummingbird makes him “it” in a similar game of avian “tag”.

This territorial dominance, which all may see, has impressed observers from the earliest times and suggested the common name “kingbird”. Scientists, who proposed technical names for the birds, likewise have commemorated the spirited behavior of the species in such terms as: *animosa* (animated or bold), *despotes* (a despot), *intrepidus* (intrepid), *melancholichus* (having black bile or being atribilious, i.e. cantankerous), *satrapa* (a satrap or governor), *tyrannus* (a tyrant), and *violentus* (violent). A little homily might here be imparted to the effect that the classical languages are so largely basic to our own that their study should not be regarded as antiquated and impractical; but let that pass.

A point evident from all that precedes is that the kingbirds are mettlesome and courageous. They have some of the qualities so necessary to the pioneer and it is characteristic of them to venture into new country. They are impelled to wander, and they contribute many of the records ornithologists refer to as casual or accidental.

The Arkansas kingbird, whose home range is in the drier, western half of the

country, wanders throughout the East, so often as to be considered a regular visitor in such widely separated States as Massachusetts and Florida, and goes north as far as Ontario and Nova Scotia. The gray kingbird of the southeastern coast vacations to New Jersey, New York, and Massachusetts, and once, almost incredibly, to British Columbia. The common kingbird, the nearest part of whose range is Nova Scotia, has been seen in Greenland. Of greater interest are the tropical and subtropical forms, which,

from time to time, unaccountably appear in widely scattered northern localities. Of this group, but not typically so, because it nests from Texas to Nebraska, is the beautiful scissor-tailed flycatcher, or Texan bird-of-paradise. There are numerous records of its occurrence to the east and north. In Florida, it is a regular winter visitor, and at Key West gathers in small flocks, as noted by Earle R. Greene, with whom I was a fortunate co-witness on one occasion. All the way up the east coast the scissor-tail has often traveled, and it has been detected farthest north at Hudson Bay. For Massachusetts and Maine, there are several recorded visits; how many unrecorded is anyone's guess. One such may well have

been that reported to me while on Matinicus Island, Maine, in October-November, 1915. There I was told by persons, inquiring for the name, of a strange bird seen on the island both in 1914 and 1915. The visitor of the latter year remained near one house for more than a week. The informants were persons making no assumption of ornithological knowledge, but whose descriptions left no doubt that the species new to them was the scissor-tailed flycatcher.

The Derby flycatcher, which normally reaches the Rio Grande Valley in Texas, has been seen in California; Lichtenstein's kingbird, at

(Continued on page 444)



The Arkansas kingbird, and, below, the Eastern kingbird.



Tempus Fugit, or Age, Please?

By E. LAURENCE PALMER

Illustrations by E. M. Reilly, Jr.

WHILE most of the units of this series of inserts have dealt with rather limited groups of organisms, such as fishes, birds, rocks, trees or insects, we have had a few of general nature. Among these have been the units on sounds and hearing, tracks and tracking, and on living about. Now we have one concerned with the effect of time on the common things we see about us. In the first rough draft, we included the story of time and its interpretation through the study of fossils, of land forms, and of the chemical content of the sea and other bodies of water. It became obvious that if we treated these aspects of the subject adequately we would have to exclude many details about the effect of time on living things. And so we confine ourselves this time to living things. We say this because past experience tells us that unless we do give this explanation some will write in and point out an obviously important omission in this particular offering.

We must further define our subject as excluding some of the most obvious and personal evidences of the passage of time in living organisms. And because there is so much of interest in connection with records of time on other organisms, we cannot use the space to deal here with man, to us the most important of all living organisms.

Check up on yourself to-day to see how often you try to pass judgment on the age of this or that thing about you. You recognize a babe, a child, a youth, a mature adult, a middle-aged person, an elderly individual and a really old person, but if you have to stake your reputation on guessing the age of the next person you see you must admit that in many cases you are likely to err. While you may profess to believe that man is immortal, you are definitely conscious of the importance to you and to others of the use made of the span in finite time during which we are mortal. You may quote: "Time, what is time? Leave time to dogs and apes. Only man is immortal"—but you do recognize the significance of age on things other than your car.

If you buy a horse, an orchard, a dog, or a tree with any expectation that you are to gain profit from your ownership it is important that you be able to form some rational judgment as to how long those services may be expected. A horse in its prime, but on the threshold of old age, will give you fewer years of service than one just coming into its prime. You should be able to determine its age with some degree of accuracy. Again, before you enter into any scheme for profit where living things are involved, you should know well what the significant time span may be. It may seem like an easy way to make a living to raise frogs legs or diamond-backed terrapins, but unless you know the life

cycles of these creatures the chances are excellent that your proposed venture will lead to disappointment rather than to happiness.

There are all sorts of "old wives' tales" floating about that may have reasonable, or little, validity. You should

be aware of the degree to which you may depend on such rumors. Can you determine the age of trees by the rings in the wood, of turtles by rings in the scales, or of clams by the rings on the

shells. True, you can make an approximation in each of these cases, but how dependable is the approximation?

Offhand, you may be inclined to rely on a few other criteria to help you reach a conclusion. You may assume that great size is an evidence of age; that gray hairs, absence of teeth, uncouth appearance, lack of pep are safe guides in determining relative age. And if we define age in one way, some of these signs may be of greater significance than any accurate statement as to the number of years the organism has lived. We have all seen human beings who were "older" at twenty or thirty than were others at thirty or forty. Liberty Hyde Bailey, at 89, is engaged in making explorations seeking new palms, a task that plenty of men at forty or fifty would hesitate to undertake because they think they are "too old." Possibly *they* are right. So while we may here give you some evidences of age in plants and animals you should never take any of them too seriously, for even if a horse's teeth may show it to be only five years old, it may have been so abused during those five years that its future is less bright than a horse whose teeth indicate clearly that it is much older. Teeth, rings, hair color, reproductive ability, and so on, are all straws in the wind that *help* evaluate the probable age of some of the organisms that live about us.

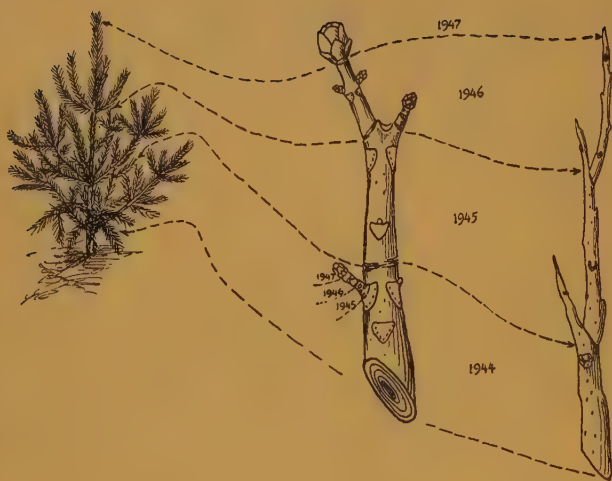
Evidences of Age in Woody Plants

It may be well to begin this study of age in living things with an examination of some groups that show indications as to their age.

On the next page we show you some sketches of parts of some common woody plants. On the left, in the first illustration, is a young, growing pine. Beside it is a twig of a horse-chestnut. Still farther to the right is a sumac twig. Still farther on is a cross section of a stem that might be a pine. Can you read the complete stories involved in these pictures?

In the case of the young, growing pine we do have some reliable evidence of what may have happened to it in recent years. The uppermost "lead" was obviously produced during the current year's growth. Below it is a whorl of

This is the forty-sixth in Nature Magazine's series of educational inserts.



Can you read the story of age told here? First is a young, growing pine; then a twig of horse chestnut; next a sumac twig; finally a cross-section of a stem that might be that of a pine. Each tells an interesting story.

similar branches that arose from a cluster of buds that crowned last year's growth. Farther down the main stem is a second whorl of branches that obviously began a year earlier than the uppermost whorl. Similarly, a lower whorl antedates by a year its superior whorl. And so, with this to help us, we can reason with some safety that it took three years for the pine to develop the portion we see above the lowermost whorl. This does not tell us the actual age of that individual pine, but it does give us a reasonably safe judgment about the time span necessary for the growth of the uppermost portion of the plant. How long it took for the lower portion to develop is not always so easy to determine or so obvious. In some of our evergreens the seeds may take a year or so to develop to a point where they may germinate. In others, they may be held in the cones, or elsewhere, for a year or more after they are perfectly able to germinate were they properly planted. In some the germination is quick, in others it is slow. So, really to get the exact story of the age of that individual pine is something beyond the possibilities of this article.

At the top of the horse-chestnut twig we see a huge bud from which the growth of the current year will develop. Similar growths will develop from the lateral buds below. Below these we find a scar extending clear around the stem

where the terminal bud of the preceding year began its development. The space between the terminal bud and a terminal bud scar, therefore, represents a year's growth. Looking farther down the twig, we find another terminal bud scar marking the beginning of another year's growth. Using this method we can read the age of the twigs of many woody plants.

It should be noticed in the horse-chestnut twig that there is a type of scar at the beginning of the 1946 growth not obvious at the beginning of adjacent years. This scar has stopped growth and caused a branch or fork to form. At this scar a flower-cluster was borne, so we can say with some assurance that this twig was terminated in 1945 by a cluster of flowers, and that no such cluster was borne on this twig in 1944 or 1946.

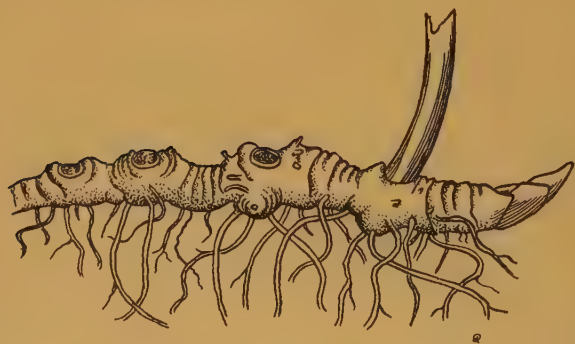
Now, if we look at the sumac twig we will see something different. In this species the new growth for a year begins with some lateral bud back from the tip. Usually the area above this bud has been winter-killed and does not bear leaves or develop twigs. This situation creates a stem that looks much like the branching found in a deer's antlers. The name staghorn sumac gives recognition to this resemblance. A twig that develops in this manner may have its age read easily, even at a distance.

A glance at the drawing of the base of the horse-chestnut twig will show a series of concentric lines. The bark is of course bounded by the two outermost circles. Inside the bark there are concentric bands of wood, each of which might normally be expected to represent the growth of a year.

As a twig increases in size the bark must stretch to give the expanding center room, or it must become ruptured and worn off. Because of this we cannot always depend on the characters we have been considering to determine the age of trees. Where whorls of branches are formed yearly, as in the pines, the age may be computed with some accuracy, but in most trees this is not possible.

The picture to the right of the twigs shows a cross section of the stem of some woody plant, such as a pine. The concentric lines there give us some clue as to the relative prosperity of the tree in different years, and even as to the competition the tree may have had to face during its lifetime.

While these characters we have been discussing may be



Some of our common herbs reveal their ages to the knowing. Here is a drawing of the underground parts of solomon's seal. It tells its age.



A fish carries on its body clues to its age. Here is a drawing of a fish scale that reveals to the knowing how the finny individual's growth varied, just as the rings of a tree show growth.

satisfactory for our purposes, they are not always completely dependable in the eyes of the law. Under certain unusual circumstances a tree may form more than one ring in a given year. If a tree has formed its usual quota of leaves for the year, only to have them completely destroyed by a scourge of caterpillars, or even in some cases by a flash fire, new leaves may be developed and the unusual development may be recorded in the rings in the stem cross-section.

If you have learned how to read the evidences of time on the twigs of some of our trees you should have little difficulty in determining the age of some relatively common herbs. One of the easiest of these to read is that shown by the underground parts of solomon's-seal. In the illustration here given the bud that will form the erect shoot for the year is shown to the right. A short distance to the left is the dead base of last year's erect portion. Still farther to the left are shown three scars, each representing the spot where one of the annual erect stems had developed. Thus you should be able easily to date the growth on plants of this sort.

Many of the early woodland flowers make excellent subjects for studying this feature of Nature. Toothwort or dentaria, wild ginger, and mandrake or may-apple, are among the many you will want to look at in this connection. These plants are, of course, not annuals, and since they are relatively long-lived it is sometimes challenging to explore the underground systems of a patch of such plants to try to determine how they developed, and when one plant branched from another.



Many of our mosses show on their erect stems definite areas that indicate spots where a year's growth was begun or ended. Some of these were figured in an earlier insert on these pioneer plants. Similarly, some of the club mosses show definite areas where spores were borne in years past. These help in the determination of the age.

If we could develop this story indefinitely we should include here information on the recognition of the

What happens to a sheep's teeth. At the top the lower jaw teeth of a lamb, then four succeeding years of the change in tooth condition. One who knows his sheep can take a peek at these teeth and determine the age of the animal.

seedlings of the many plants we can recognize in their mature state. This is of great importance to gardeners, who must recognize young beets, radishes, lettuce and squashes if they are to help them by destroying young, competitive pigweed, pussley and amaranth. On our puzzle page at the end of this unit we have included illustrations of the seedlings and adults of some common plants. If you find that you are hopelessly unable to recognize these common plants you might start by watching what unknown seedlings develop into, so that next year you may be better informed. If you feel that such information is worth while, and would make your wants known, we might prepare a subsequent insert giving this problem more consideration.

Telling the Age of Fishes

A number of my friends are avid fishermen. Some of them will fish all day, and as soon as they make a catch they will return the fish to the waters from which they took it. This makes it possible for them to have again the pleasure of catching that very fish.

Possibly I am inaccurate in intimating that my friends return their catches immediately to the water. This is not quite true. As a rule they make a record in a little book noting the kind of fish, its size, sometimes its weight, and other data, including records of the bait used. Then some of them take a knife and remove one or more of the scales and store these in an envelope or vial. An examination of these scales often tells these ichthyologist friends of mine approximately how old the fish was, and how it had prospered through the years. To help you understand how they reach their conclusions, I have drawn a sketch of a scale of a fish that shows definitely how its growth varied. As in the case of rings in the trunk of a tree, the growth of a year is frequently indicated by some unusual development. In the fish whose scale is here shown, the end of a year's growth was characterized by more closely crowded rings of growth.

We read frequently that the



Five years in the development of the goat's teeth. Their change is similar to those of sheep, but here we have a look at goat teeth from a different point of view, looking down on lower jaw.



Reading from top to bottom, the change in a cow's teeth, starting at one year, then 18 months, 27 months, three years, four years, and ten years.

age of a trout may be determined by its size. In a given brook the trout of equal size are probably of about equal age, but those in an adjacent stream may be larger or smaller, depending in part on the temperature of the water, but more important is the abundance of food and the length of the season when the fish may be actively feeding and growing.

Age Signs in Reptiles

Many people have convictions regarding their ability to determine the age of reptiles. They may tell you that they can estimate the age of a rattlesnake by the number of sections in its rattle. Unfortunately this evidence cannot be accepted as valid. When a rattlesnake sheds its skin, the tip of the tail remains attached to the previous tailtip. This may, in turn, be attached to earlier tailtips. So, the rattles on a rattlesnake tail may help you to understand how many times he has changed his skin, but they give no indication of the number of years the animal may have lived. Also, in an old snake the last of the rattles may be broken free from the earlier rattles; so the number of rattles is only a weak criterion at best.

Another old wives' tale about the age of reptiles is that the concentric lines on the scales on the back of some turtles, such as wood turtles or the terrapins, indicate the exact number of years the animal has lived. This is probably no more valid evidence than that provided by the scales at the end of the rattlesnake's tail. They may indicate periods of growth, but they do not indicate the end of development for a given year. They cannot, therefore, be used to determine age with any degree of dependability.

Certainly there has been much controversy about the means of estimating the age of alligators. It is to the advantage of the showman, or of the Nature thrill writer, to make the public think of their subject as being ancient. It is much safer to recognize that, as with some of the fishes, growth is dependent largely on the opportunity the animal has to feed well and long.

Of course we have periodic reports of people having found horned lizards imprisoned in rocks for a long period of time and coming promptly and vigorously into active life again when they are freed hundreds or thousands of years

after an earlier accidental incarceration. All of this sort of stuff is of course pure blatant journalism. If you do not believe that it has gained a following with the public, however, ask the next ten persons you meet how they think about it. You probably will be surprised at the result.

Age in the Amphibia

Unfortunately it is not easy for us to determine the age of a frog or toad. If those huge jumbo bullfrogs we see advertised should show their true age to any inquirer, there would be few patrons of the advertisers who seek to set you up in the frog business by selling you breeding pairs at \$17 a pair, on the assumption that within a year you would be able to harvest a wealth of frogs' legs for use on your own table or for sale to the market. This story was presented to you in greater detail in an earlier unit of this series.

Age in the Invertebrates

To the trained student of invertebrate zoology there are many ways in Nature that help one understand the probable age of an invertebrate animal. A cicada may take seventeen years to develop, but a close relative may complete its life cycle in a much shorter time. Economic entomologists who can observe the populations of immature insects can predict with considerable assurance epizootics of adults of those insects. Unfortunately, we cannot here give you much of that story. We can suggest that it might be worthwhile to try to improve your ability to recognize the adults, immature forms and younger stages of a considerable number of common invertebrate animals. I am sure that none of you would make the remark once made by a teacher to Professor J. G. Needham. She said that she marvelled at the ability of polliwogs to turn into beautiful butterflies. But this is about in the same class with the published statement of a prominent science educator, who said that he had his students observing insects turning into butterflies.

To test your ability in this field, we have sketched a few immature invertebrate animals and the ma-



Surface and side views of the lower incisors of a horse at three, four, five, six and eight years. Take a look at a friendly horse's teeth and see what you find as to the animal's age.

ture forms of the same insects. See how successful you may be in putting the proper young with their adults.

Knowledge of the length of span of life of many invertebrates may be of importance to you. You may be reasonably sure that a brook that supports stoneflies functions throughout the year, since most of these insects require approximately a year in the water to complete their life cycle. Similarly, it may be significant to you that insects requiring a long growing season to reach maturity cannot become pests in a short season. This opens up a whole series of interesting observations and conjectures.

Earlier we called to your attention the popular belief that you might tell the age of a clam by observing the number of eccentric rings on its shell. While these rings do indicate varying growth they do not chronicle authoritatively the passing of the years.

Age in Birds

In several of the earlier inserts in this series we have given rather detailed information regarding evidences of age in different birds. We can here do little more than refer you to that, or to similar material. While some birds will assume the appearance of their parents within a relatively few months after they have hatched, others may take years to reach that degree of development. A bald eagle, for example, does not develop the white head, characteristic of the adult bird, until the fourth or fifth year of its life. A robin that may be hatching in a nest outside your window this summer may return next year a practical "spit-tin" image" of the parent birds.

In those birds where the male is conspicuously different from the female, those differences may become evident at different ages. A cock pheasant may be readily identified as a cock bird in relatively few months after he pipped his shell. On the other hand, some of our warblers may have males that retain the plumage similar to the female even after the males have reached a stage of sexual maturity.

There are, of course, legends that have been built up about the great age of some of the longer-lived birds. We have relatively reliable records of some birds, such as the golden eagle, that have lived more than 100 years.

Records of Age in the Mammals

With most mammals we accept the teeth as being one of the best indicators of age. We know that the condition of



Teeth of swine. From top to bottom, incisors at birth; incisors at one month; molars at one month; incisors at three months; temporary incisors and tusks at nine months; central and permanent incisors and tusks at one year and the dental equipment of a mature hog.

teeth in humans varies with individuals, that some get their teeth earlier than others, and that some keep them longer than others, but in general teeth do tell us much about the age of a mammal.

As with us, most mammals have both milk teeth and permanent teeth, and the milk teeth appear in a more or less constant order and are replaced by the permanent teeth in a regular sequence. If we know at about what age these teeth appear or are lost, then we can have a reasonable judgment as to the age of an animal whose teeth we are examining.

We might assume that all readers of this article can recognize the types of teeth found in mammals and represented in our own mouths. We will not consider that you are cribbing on your exam if you feel of your own teeth for a minute.

In a normal human adult, the teeth that are featured in the movies and in dentifrice advertisements are the cutting teeth or incisors. We should have two of these on either side of each jaw or a total of eight. These are the teeth featured by the "chisel-tooth tribe," including the rabbits, squirrels and beavers. Next in line in our heads are the canines or "eye-teeth," displayed by villains in the movies, as well as by the cats, dogs and other carnivora. We have one of these on each side of each jaw, or a total of four. In general these canine teeth and incisor teeth provide us with most of the information we need to form a reasonable judgment of the age of a domestic mammal.

Behind the canines on our jaws are the bicuspid, and behind them the grinding molars, but for the purpose of this article they are not very important. If you can recognize incisors and canines in the average mammal, and have some ability to interpret their condition, you can be a reasonable judge of the animals' age. Once you have gained some confidence in this method of telling age you will understand better why we say that one should not look a gift horse in the mouth. If it means that you may have to feed and care for an ancient nag for some years, then it might be just as well to look at a gift horse's mouth before you accept it.

The Story of a Sheep's Teeth

There are many things about sheep that help you understand something of their age. A lamb is borne by the ewe 146 days after she was mated with the ram. In about two hours the lamb may begin nursing and at two weeks it is sufficiently developed to begin to nibble hay. At that time the owner in all probability will dock the



animal's tail, and the males that are not to be saved for breeding purposes will no doubt be castrated and become wethers. During the first year the lamb will develop only its milk teeth. At one year, the first pair of permanent teeth will have developed and should be distinguished easily from the three milk teeth that are behind the first permanents on each side of the lower jaw. At two years of age the sheep will have developed a second pair of permanent teeth adjacent to the first; at three years a third pair, and by four years the animal should have only permanent teeth at front on the lower jaw. The life span of a sheep is normally about 15 years, during which time the permanent teeth naturally become more and more worn. Ewes are first mated to rams when they are about 1½ years old. With this help you should be able to inquire intelligently into the age of the average sheep you have the opportunity to examine.

How to Get Your Goat's Age

The story of a goat as told by its teeth does not differ

greatly from that of a sheep. We have shown the side view of the development of the teeth of a sheep. For the goat we show a view looking down on the lower jaw. If, without reading further, you try to identify the changes that take place in the dentition of a goat, you will see how closely it resembles what you have already learned about a sheep. The initial four pairs of incisors are replaced at yearly intervals by a new pair of permanent incisors. Therefore, by the fifth year we can expect all of the lower front teeth to be permanents. From then on age will be indicated more by the degree to which these teeth are worn than by the appearance of any new teeth.

The general story of the life history of a goat runs something like this. The kid is born from 147 to 155 days after the buck, or billy, mated with the female doe, or nanny. The kid follows its mother largely because she is an excellent source of food after the first four or five days. The kid may reach maturity in from eight to twelve months, and be considered as an old animal by the time it is six years old. It may live to an age of fifteen years, however.

How Old Is That Cow?

In these days of meat shortage we are inclined to pass judgment on the age of the meat we may be forced by circumstances to eat. We know something of the difference between veal and a tough old steak. But are we equally able to judge something of the age of a living cow?

This is not too hard if you have learned reasonably well what we have given you about sheep and goats, relatively close kin to our cows. In all of these animals, we use the front teeth on the lower jaw to guide us. If you have been following directions, and have looked at

some sheep or goats you have discovered why we do not use front teeth on the upper jaw. The reason of course is that there are none.

In our sketches of the teeth of a cow, we have shown how they appear at the end of one year, of 1½ years, 27 months, 3, 4 and 10 years. A reasonably critical examination will show that the original 4 pairs of milk teeth are replaced, beginning at the front, by pairs of permanent teeth, and that all are replaced by the end of four years. From then on the permanents become more and more worn.

Calves are born from nine to ten months after the cow has mated with a bull. During the second year, the calves are known as 2-year-olds. A young female is known as a heifer, and if it was born as a twin with a male it is known as a freemartin, and is usually not fertile. Young bulls are castrated and develop into steers. Mature bulls, when castrated, are known as stags, and may be worked as oxen. Well-grown young heifers may be bred when they reach an age of 18 months. The life span of a cow may be 20 years, but its years of best production of milk, or of

young, are much less.

Now, About That "Gift-horse"

While a cow's life span is normally not more than 20 years, a horse may live to 50 years. The horse matures more slowly than the cow, and requires from 11 to 12 months for development before it is born, as contrasted with 9 or 10 months for the cow. This relatively slow development in the horse is reflected in the correspondingly slow development of the teeth.

The sketches given here show the surface and side views of the lower front teeth of horses ranging from three years old to those older than eight. You probably will get more from studying the pictures than you will from anything you might read in this text, but it may not be amiss to call attention to the variation in the appearance of the surface of each of the teeth. Certainly the shape of the center area varies rather consistently, and may be used as an index of development. Then again, the side view shows the development of the cutting edges of successive teeth, and, finally, the development of the relatively small canines a short distance back from the last incisors.

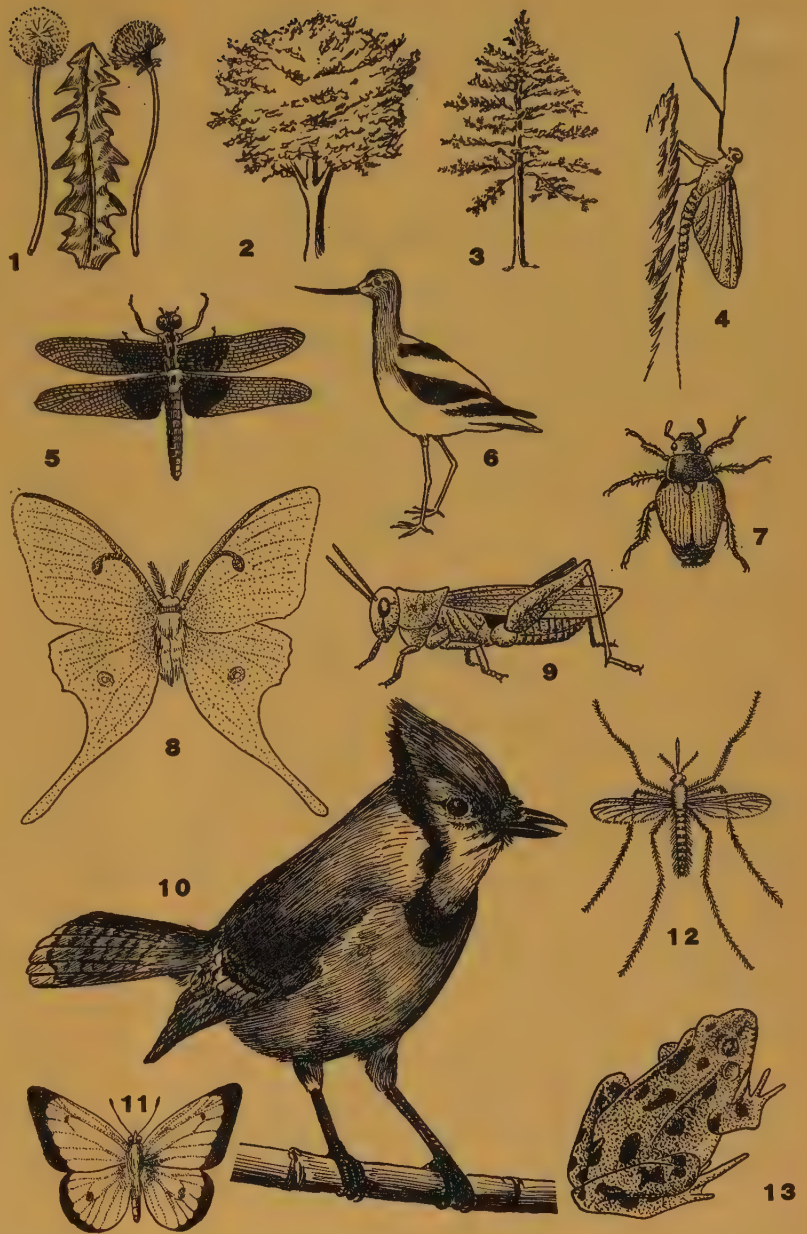
By this time you should have noticed that our horse differs from the cow, goat and sheep in that it bears front teeth on both the upper and the lower jaws. This makes it possible for the animal to do a different kind of job in clipping off its vegetable food. Certainly it can clip grass closer to the ground than can a cow.

Young female horses are known as fillies, and young males as colts. Males that are castrated before reaching maturity develop into geldings, while those so treated after they have reached maturity are known as stags. A mare is bred to a stallion after she has reached an approximate age of three years, and a mare kept for breeding is known as a brood mare.

Pigs Is Pigs, Sometimes

The first little lesson we learned about the teeth of lambs and some other domestic mammals may be useful in interpreting the age of a pig, providing the pig will let you look him over properly. The only way in which this helps, however, is to provide us with more ideas as to which teeth we may expect next. The canine teeth, about which we have so far had little to say, appear in a pig's mouth as shown in the sketch. Here we have shown the approximate time and the order in which the milk incisors appear in pigs. We have also shown how the canines and molars appear in relatively young pigs. These pictures, and a glimpse at a pig's tooth equipment, may increase your respect for the possible damage a pig might cause with its mouth. You should notice which of the canines develop into the really effective tusks.

If we must use the term pigs correctly, we should review



the names that are applied to the swine of different ages. Swine that are just born are pigs. They remain pigs until they are weaned by the sow, and then they are known as shoats. Young females are known as gilts, and mature females as sows. Pigs are born to a sow about 112 days after she has mated with a boar, and two litters of pigs may be produced by a sow in a year if she is managed properly. Young males that have been emasculated are known as barrows. Pigs are usually weaned when from 10 to 12 weeks old, and a sow may be expected to breed well for some six years. You may see from this how important age is in determining the proper name that we may apply to the swine we may see on farms.

Teeth and Age in Some Other Mammals

It is doubtful if all readers of these pages will have the opportunity, or the inclination, to examine the teeth of all of our domestic mammals. Some of the animals object effectively to any such attempt on our part. Most of you will have a chance to observe the teeth in a dog, and with

perfect safety. Sometimes it is well to know how old a puppy is, since we know that they are often subject to temper at from 8 to 10 weeks of age. If we have not had the opportunity of knowing when a stray pup was born, it might be well to be able to give an approximate age by observing its teeth.

Briefly, the important tooth changes that take place while a dog is growing are as follows. So far as the milk teeth are concerned, the first and second incisors have developed by 4 to 5 weeks; the third incisors, at 4 weeks; the canines, at 3 to 4 weeks; the first and second premolars, at 4 to 5 weeks and the third and fourth premolars, at 3 to 4 weeks. The permanent teeth appear as follows. The incisors and canines, at 4 to 5 months; the premolars, at 5 to 6 months; the first molars, at 4 months; the second molars on the upper jaws at 5 to 6 months; the lower second molars, at 4½ to 5 months and the third molars at 6 to 7 months. Now hop to it. Look your pup over and see how closely you can determine his probable age.

A puppy is born from 59 to 63 days after its mother mated. It is blind at first, and unable to hear for from 10 to 12 days. It nurses for from 4 to 8 weeks and becomes mature in from 7 to 10 months. The life span of a dog may be to 20 years but is usually much less than that.

We have given you two pages of pictures of young and old plants and animals. No doubt many of these are such that you would have little or no difficulty in tying young and parent together. Some will not be so easy, and I have reason to believe that many will not make a perfect score. After the letter accompanying each young plant or animal write the number adjacent to the picture of its parent. Cer-

tainly few will think that the young bluejay has a dragonfly for a parent, and I rather doubt if any will think that its parent is the long, slender-billet avocet. I doubt that many will fail to recognize the tadpole as the young of the frog, but I am sure that some will be over their depth trying to make the proper groups for the insects, or even for some of the plants.

The important thing about this feature of this insert is not that you may do well or poorly with the test, but, rather, that you begin to be conscious of how young and old plants and animals look. Get a note book. In it paste all sorts of pictures of young creatures in one part, and of the corresponding adults in another part. See how well your friends can make the proper associations. As you progress, you will be less and less satisfied to recognize that a tadpole develops into a frog, and more and more insistent that you be able to recognize that the tadpole of a bullfrog differs from that of the green frog. To help you on many of these matters we can refer you to the life history charts that have featured this series since it was started. You may care to make collections of some kinds of things to show how old and young look, in preference to using pictures. Eventually you may become more or less masters of understanding the changes that time produces in the living things about us. Should you become sufficiently proficient in this matter you might well become a successful doctor, farmer or naturalist. Certainly you will become a better informed citizen.

The proper associations of young and old organisms shown on the two preceding test pages are as follows: A-9; B-13; C-10; D-3; E-1; F-2; G-11; H-7; I-12; J-8; K-6; L-5; M-4.

Inserts to Date

For the benefit of those who may wish to refer to previous inserts in this series they are listed below by title, month and page number.

1. Some Common Fresh-Water Insects, Oct. 1938, P. 477.
2. Weeds Above the Snow, Dec. 1938, P. 597.
3. The Sky at Night, Feb. 1939, P. 85.
4. Some Common Reptiles, April 1939, P. 205.
5. Some Common Food and Game Fishes, June-July, 1939, P. 325.
6. Some Common Rocks and Minerals, Oct. 1939, P. 445.
7. Domestic Mammals, Dec. 1939, P. 573.
8. Some Common Marine Animals, Feb. 1940, P. 93.
9. Upland Game Birds and Waterfowl, April, 1940, P. 213.
10. Atlantic and Gulf Coast Shells, June-July, 1940, P. 341.
11. Nuts (Common nut trees), Oct. 1940, P. 461.
12. Our Fur-Bearers, Dec. 1940, P. 581.
12. Deserted Deserts (Desert Life), Feb. 1941, P. 85.
14. Marshes and Their Environs, April, 1941, P. 205.
15. Weed Patches and Waste Places, June-July, 1941, P. 325.
16. Our Fruit Stores, Oct. 1941, P. 445.
17. Circus and Zoo, Dec. 1941, P. 557.
18. Rooting in the Root Cellar, Feb. 1942, P. 81.
19. Let's Pray for the Preying Birds, April, 1942, P. 193.
20. Our Feathery Plant Friends—The Ferns, June-July, 1942, P. 305.
21. The Spirit of Fall Flowers, Oct. 1942, P. 417.
22. Along Came A Spider, Dec. 1942, P. 529.
23. Hello! Do You Hear Me? (Sounds), Feb. 1943, P. 81.
24. Some Western Birds, April, 1943, P. 193.
25. Living Out, June-July, 1943, P. 305.
26. The Tie that Binds (Fibers), Oct. 1943, P. 417.
27. Evergreens Forever, Dec. 1943, P. 529.
28. Your "Yarb" Garden (Herbs), Feb. 1944, P. 81.
29. A Universal Sky Chart, April, 1944, P. 193.
30. Some Common Amphibians, June-July, 1944, P. 305.
31. Cereals and Kindred Grasses, Oct. 1944, P. 417.
32. Some Eastern Birds in Winter, Dec. 1944, P. 529.
33. Some Eastern Ornamental Trees, Feb. 1945, P. 81.
34. Pacific Coast Shells, April, 1945, P. 193.
35. Some Common Mushrooms, June-July, 1945, P. 305.
36. Household Enemies (Insect pests), Oct. 1945, P. 417.
37. He Who Runs May Read (Tracks), Dec. 1945, P. 529.
38. Seaweeds, Feb. 1946, P. 81.
39. Spring Flowers, April, 1946, P. 193.
40. Shore Birds, June-July, 1946, P. 309.
41. Some Butterflies and Moths, Oct. 1946, P. 417.
42. Cactuses, Dec. 1946, P. 529.
43. Pioneer Plants, Feb. 1947, P. 81.
44. Warbler Time, April, 1947, P. 193.
45. Some Galls of Woody Plants, June-July, 1947, P. 305.

As We See It

WATERFOWL SEASON

From the U. S. Fish and Wildlife Service, for release on August 1, came a statement in which the Director, Albert M. Day, declared: "Late reports on waterfowl conditions on most of the northern breeding grounds received from Canadian wildlife officials are extremely discouraging. . . . It is safe to say that even with good nesting conditions we failed to send back the brood stock that we should have sent to populate effectively the marsh areas that came back this year because of improved water conditions. Lakes without nesting ducks are of little importance in producing a crop. It takes ducks to produce ducks. We are in for a poor shooting season."

The release quotes official observers, both Canadian and from the United States, who found the situation bad. Flood conditions in some areas wiped out the first broods. Fewer breeding birds of several species were to be found. Underpopulation was generally observed.

It seemed, from the dire character of this report, that the Fish and Wildlife Service was preparing the duck hunter for a closed season. But close on the heels of the release came announcement of a shorter closed season, with a smaller bag limit. In the judgment of the officials charged with weighing all the evidence, such an open season could be risked. We think it is a risk; that it is a case, as in the early thirties, of taking the long chance with a wildlife resource. In point of numbers the birds are not as dangerously reduced as they were during that earlier crisis, but the hunting pressure has at least doubled since then, so, in our opinion, the danger to the future of the birds is just as great, if not greater.

The regulations cut the length of the season to thirty days in the East; thirty-five in the West, with States allowed choice of split seasons of fewer total days but greater potentialities for destruction. The bag of ducks is cut to four a day, and eight in possession. With respect to both ducks and geese, geographical variations are allowed, and the zone provisions continue so that the birds will have to endure, from October 7 to January 6, a longer gauntlet of fire than a thirty-day season suggests.

Entering into any decision on the migratory waterfowl season, in addition to the condition of the birds, are the facts that a closed season would have eliminated revenue from the duck stamp, cut States off from license income, and reduced the amount of Pittman-Robertson funds derived from the tax on arms and ammunition. The Fish and Wildlife Service and the State Departments could anticipate no source of

public funds to replace this revenue, so continued shooting was permitted in the hope that we can "get away with it" again.

We sincerely hope that the authorities have not taken too long a chance. If they have, and our migratory waterfowl are reduced to the point of extirpation, they will hear not only from the lovers of birds, but from the duck hunters and the commercial interests concerned with gunning.

We hope that the reduced bag, and the widely publicized facts of decreased numbers of birds, will keep many gunners from the blinds. We personally know several who say that they "will not go to the expense of getting out their gear for so small a legal bag, and who think that the birds should get a rest anyway. We trust their ranks will be joined by many others. Even so, we repeat our earlier conviction that a closed season would have been the wisest and safest course. It could have been more easily enforced, what with mere possession being *prima facie* evidence of guilt, and would have permitted a greater check on the considerable drain of illegal shooting. Our interest, of course, is only in the birds and their perpetuation in adequate numbers of all species. We do not begrudge the duck hunter his bag, if he finds fun in it and if the birds are safely numerous. We do not believe, however, taking the country as a whole, that our migratory waterfowl are safely numerous, or that they should be shot in 1947.

NEWCOMER TO PARK FAMILY

AFTER nearly twenty years of endeavor, Everglades National Park has become a reality and becomes the twenty-eighth member of the National Park family. Following authorization by Congress, the Secretary of the Interior has accepted from Florida's Governor M. F. Caldwell a check for two million dollars appropriated by the State for park land acquisition. Into this park are transferred 454,400 acres in southern Florida. These acres constitute the only sub-tropical area in the United States thus protected. Placing them in National Park status will protect the wildlife of the area, and the extensive watercourses, vast mangrove forests, sawgrass prairies and mixed forest areas that this wildlife inhabits. Land acquisition and administrative details must be worked out before the park can become fully operative, but we may now congratulate ourselves that a wise Florida and a wise Nation have moved to preserve for posterity an area of such interest and significance.



PHOTOGRAPH BY ASAHEL CURTIS, COURTESY WASHINGTON STATE HISTORICAL SOCIETY

Photograph of bitterroot taken at Dry Falls, Washington. This is in the Grand Coulee district, an arid spot where, ages ago, there was a waterfall many times bigger than Niagara.

Montana's Historic Bitterroot

By JESSIE L. DUBOC

BY POPULAR vote throughout Montana, the bitterroot, *Lewisia rediviva*, became the people's choice for a state floral emblem in 1894. Victorious over its thirty-one rivals, it captured nearly two-thirds of the votes. The next year, it was unanimously adopted by the Legislature. In 1919 attempts were made to change the state flower to one more commonly seen, but these efforts failed. No other plant distinctive of the Northwest could be found that possesses as many unique characteristics and had played so large a part in local history.

The bitterroot is an adventuresome little wild plant. It flourishes on open ridges in high altitudes, or it pops up suddenly in early spring on flats at lower elevations. Its queerly branched taproot reaches down into crevices of rocks; in fact, it is frequently called rock rose. Dry, thin, light soil attracts it. River bars and timberless, stony slopes are among its favorite haunts.

In its habitat, the bitterroot is frequently overlooked. Before and after the blooming period, it cannot readily be located. The plant is identified chiefly by its flower. The tiny leaves are of no assistance for identification, for their life span is short. Each roundish leaf is only about a fourth of an inch in diameter and less than two inches in length. The leaf-rosette springs from the center of the root stalk and lies close to the ground. It is not easily detected even when green. About the time of the first bloom-

ing, the rosette droops and then finally disappears.

The bitterroot defies photographers. Even expert cameramen cannot snap the leaves and flowers on the same film. It is a common experience to hear them acknowledge defeat in their attempts to secure acceptable views of the flowers, for the plant is low-growing. In its common habitat, an arid region, the exquisite, rose-tinted flowers are conspicuous. They rise on leafless stalks two or three inches above the leaf-rosette. The numerous yellow stamens add charm to the many narrow petals of pinkish hue.

Few state flowers have received more honors than *Lewisia rediviva*. It has been pictured on calendars, souvenirs, stationery, and medals. Its design was carved on the desks in the legislative chambers in the state Capitol. Physical features are called Bitterroot: fertile valley, range of mountains, river, national forest, and trails. Organizations use its name.

In 1901, a representative of a Butte firm was sent to Belfast, Ireland, where he placed an order for two qualities of damask tablecloths, specially woven with a bitterroot design. A carload of this beautiful linen was shipped direct to Butte. Today, these cloths are prized heirlooms.

Specimens of the *Lewisia rediviva* have been placed in herbariums, both private and institutional, all over the world. Four of the ten collections made before the year 1862 were taken to Europe.

The first part of the scientific name, *Lewisia*, honors

This photograph of the bitterroot blooms was taken by Ernst C. Peterson of Hamilton, Montana, in the famous Bitterroot Valley. These plants were found in a wooded area although they are more commonly to be discovered in more open spots.



the illustrious Captain Meriwether Lewis of the Lewis and Clark Expedition of 1804-1806. Lewis discovered roots of the bitterroot in an abandoned Flathead Indian camp near Missoula, Montana, in July, 1806. The journals of this famous expedition are credited with having provided the white man with his first knowledge of this plant. The Academy of Natural Sciences of Philadelphia is the proud possessor in its herbarium of the Lewis specimen of bitterroot. The second part of its name, *rediviva*, suggests *lives again* or *restored to life*.

One ounce provides a meal. It was the small, fleshy taproot, rich in starch, that was sought by the Plateau Indians of the Columbia River basin, and still is today. Chemists have quite recently discovered that one ounce of the dried root contains sufficient nutriment for an entire meal. More than one Congressional document of the nineteenth century mentions the nutritive value of this plant.

The aborigines did not need chemists to tell them that the bitterroot was nourishing. Through long experimentation they had made this discovery for themselves. So important was this root in the food economy of Plateau Indians that it influenced tribal movements. Many bands started their spring migration with a search for it.

At Indian trading centers, such as the noted one at The Dalles, on the Columbia River in Oregon, the root was one of the staple articles of barter. A good horse was sometimes offered for a sackful of roots. Not all Indians could afford such a quantity; for them they were sold by the handful, at a relatively high price. Since the root is light and easily transported, it was usually included in the provisions taken on long journeys.

Migrations began at the plant's first flowering, usually in May. The flavor is best then. The digging was not an arduous task. The squaws placed the long, hardwood digging-stick against the abdomen and pressed on it to dislodge the root. Patience and time were required to obtain a season's supply, which was sometimes the equivalent of two grain sacks.

The preparation of the root for food was begun on the digging-grounds. First, the root was shaken free of its gravelly soil. To remove the dark-brown outer covering, the left hand held the leaf-rosette, while the

right hand slipped off the cuticle, beginning at the top of the root. This was an easy task early in the season. Later the rind adhered so closely that it was difficult to remove. Streaks of its reddish lining remained. The bitter quality lies chiefly in this cuticle. The aim, therefore, was to eliminate every vestige of it.

The next step was to wash the roots, which were then white. At the camp, they were spread out on robes to dry in the sun for several days. They can be preserved for years, if kept dry.

Roots were seldom eaten raw, for their swelling causes discomfort. After they had been thoroughly cooked, they were five or six times their original size. Occasionally, they were baked in a pit oven, but boiling was the common and simpler method. The roots were combined with meat, or berries, or a vegetable, such as camas. Deer-fat and moss were sometimes added for seasoning. Cakes were made out of pounded dried roots.

Not much is known about the use of *Lewisia rediviva* for medicinal purposes. There is some evidence that it furnished a tea that was given as a tonic, or utilized in the treatment of spotted fever. The early Chinese residents of Missoula, Montana, are reported to have made the tea for coughs.

The common name of the plant, bitterroot, was given to it by white men, not Indians. Settlers admired the beauty of its flowers, but found it difficult to acquire a taste for the bitter flavor of its root. Saunders expressed their opinion in his statement: "It is one of the marvels in the history of alimentation that the unappetizing roots (Continued on page 444)

Pop Knew Best

By RUTH MORRISON FULLERTON

Illustration by Warren A. Ruby

THE little gray lady lived in the suburbs. Her home had something of the privacy of the country with its hedge, its roomy garden with berries, fruit trees, vegetable garden, and perennial border.

One cold, snowy, winter day she was busy getting the noonday meal. The kitchen range sent out welcome warmth and the delightful, blended odors of the browning roast, baked potatoes and mince pie.

The little gray lady went to the window to look at the storm and there, as if putting on a show for her, were two cardinals. Then it came to her; the birds were cold and hungry out in the storm. In the basement the lady found a small, wooden box. Into this she put bread crumbs and nut meats, and, in high overshoes and wraps, nailed the box to the cherry tree, where it could be seen from the kitchen.

"Some storm!" her husband said, as he came in, stamping the snow from his overshoes.

"Come and see, Roy," his wife called from the kitchen window, "in the cherry tree."

"Cardinals! he exclaimed. "Pop's a beauty."

"Mom isn't so bad herself," she defended.

As the couple ate they could see the birds flitting about, brave splashes of color against the white, and then at the feeder. This became a fixture, and the little gray lady soon discovered that the birds liked tame sunflower seeds best. The bluejays became such a pest that the box was taken from the cherry tree and placed on the steps of the back porch. Pop found it there, and Mom soon joined him.

Usually the birds faced out as they ate. One day Mom became so interested in cracking a sunflower seed she forgot caution. The little gray lady heard an angry, frightened squawk. The neighbor's yellow cat had Mom's tail feathers, but Mom sat safely on the clothes line with her crest raised high in an indignant fan. So a bird bath replaced the pans, and a bird feeder was placed where it could be watched from the kitchen window. There the cardinals ate without fear while other birds kept their distance. If feed was not out at feeding time, the redbirds would come calling for it.

As spring came Pop would sing lustily to Mom, who was at the task of building a nest. She decided on the window sill of the kitchen, which provided good things to eat, and protection. Mom would bring twigs, go for more only to find that, when she returned, they had all fallen down. Finally, she chose a site in a bridal wreath bush of a near neighbor. All was well, even to the laying of the greenish-blue eggs with their reddish-brown spots, when a little girl discovered the nest and gave the bush a shake, ending that home.



So Mom returned to the home of her friend and built her nest in the Virginia creeper that grew over the kitchen window. She started the nest on July 8. Five days later came the first egg. On July 16 there were four eggs, and Mom started brooding them, her coloring blending with the vine.

One day the little gray lady was ironing when she heard Mom let out a shriek. Grabbing the broom as she went, the lady found Mom, her wings spread wide, her crest straight up, as she and Pop tried to fight off a robbing squirrel. The little gray lady went into action as Mom and Pop sat on the clothes line, shouting encouragement. The squirrel retreated to the roof, swearing in squirrel language. A second invasion was broken up and Mom finally returned to the nest.

Pop's serenading days were over; he was far too busy feeding Mom. Then there were four mouths to fill and Pop was very busy indeed. On the tenth day, those four young birds, with no tails at all, left the nest. Mom and Pop followed them about, stuffing them. Finally they were as big as their parents and still were being fed. Pop seemed to feel he had done his duty by the younger generation, so he would feed one of his offspring and then peck at it. Mom fluttered around the feeder in evident disapproval.

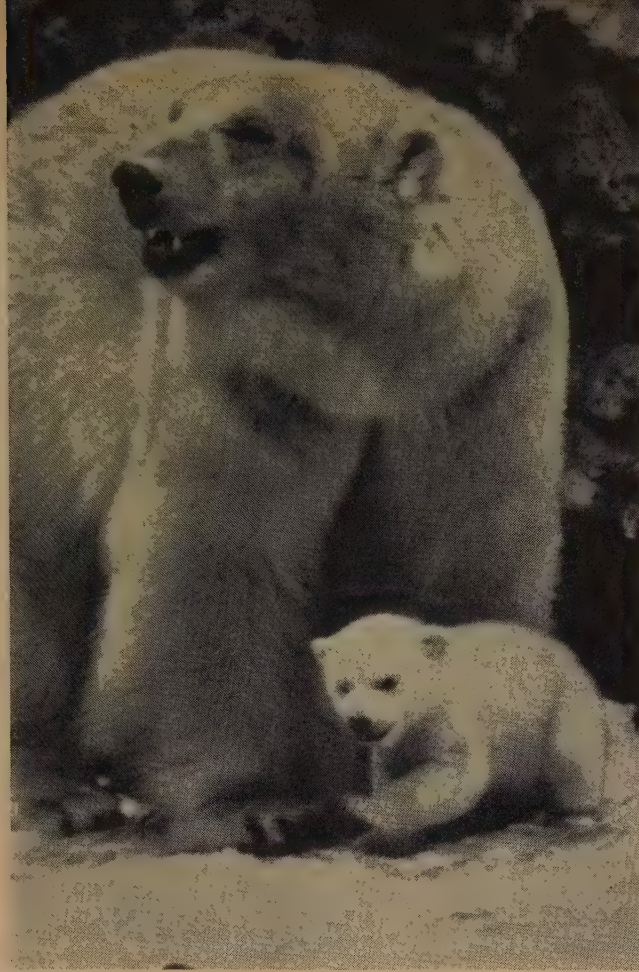
"Now, Pop," one could almost hear her say, "these babies may not be quite big enough."

"Mom," one could imagine him replying, "the gardens and bushes are full of bugs, seeds and berries."

"Pop," Mom may have answered, "these babies look full grown but they seem timid; they may need us."

Whatever the conversation, Pop lost his self-control, flew at Mom and gave her a biff. She retired to a nearby branch and watched, with little frightened chirpings, as Pop not only pushed the young birds off the feeder but drove them away. Pop and Mom lingered about, but the babies never did come back, but probably, the little gray lady reassured herself, Pop knew best.

Sultana and Sultana II, the tenth polar bear cub successfully raised after being born in captivity.



This little white baby has grown to be the present Polar Bear Queen of Milwaukee's zoo.

SULTANA, accredited by zoologists as the greatest captive polar bear mother the world has known, died in her exclusive, jagged, rocky den at the Washington Park Zoo in Milwaukee on Sunday, April 13, 1947.

Sultana was the mother of the first polar bear cub to reach maturity after being born in captivity. Proof that this accomplishment was not mere chance is found in the fact that she was the mother of ten more successfully reared cubs. Until Sultana's first born weathered its growing years in a climate far milder than that of the rigorous Arctic, scientists had despaired of raising polar bear cubs in captivity. Polar bear young had been born in zoos in Europe and America, only to die not long after birth.

Sultana is succeeded as queen of the Milwaukee Zoo by Sultana II, born to Sultana on December 10, 1931, and herself mother of two cubs, born in 1944 and 1947.

When death, resulting from slowly developing paralysis, laid its cold finger upon Sultana she was 35 years old. Age was turning her glistening white fur to an amber color, in harmony with her semi-royal name. It is recorded that a polar bear once lived to the ripe age of forty years in the Regent's Park Zoo at London, England. Although Sultana missed the longevity record, her maternal record passes into history as a valuable contribution.

Her career as a mother and entertainer ended, Sultana calmly awaited her departure from life. When the sun shone during winter days, she slowly emerged from her dark inner den to stretch out in the sun's rays on the open space before her secluded quarters. Always a friendly bear, interested in the great crowds

that came to see her in her younger years, in her declining days she seldom glanced at visitors looking her over from beyond the moat guarding her den.

As an educational entertainer Sultana possibly held a popularity record. Nearly every one of the 25,000,000 men, women and children who had visited Washington Park Zoo during her time there, gazed with interest and delight at the great, shaggy, white mother and her cubs.

Beginning in 1919, Sultana brought twelve fuzzy cubs into the world within sixteen years. Among these were three sets of twins. The only cub that did not reach maturity was her last, born on December 27, 1935, only to die twelve days later.

Like countless human mothers, Sultana had not been destined to enjoy an unbroken succession of

happy years devoted chiefly to raising robust families. Tragedy had stalked into her life several times. Among those dire events was the killing of his twin sister by the male of Sultana's first set of twins. Later this same killer son, aided by two brothers, did away with his stepfather.

During June, 1912, a fishing fleet out of Bergen, the fish capital of Norway, gathered its cargoes off the east coast of Greenland. One afternoon the fleet found good fishing near shore. While they were hauling in the piscatorial booty, members of the crews saw polar bear cubs playing together in a secluded nook on shore. Three of the ships of the fleet were scheduled to take their catches to the New York fish market. New York also is the best market in the world for wild animals for exhibition purposes. So, members of the crews made a foray on the frolicking cubs and captured four, three males and one female. The

Sultana, Polar Bear Queen

By OLIVER E. REMEY

Sultana at her den with the eleventh cub to be born to her.

four were loaded aboard one of the ships soon to reach New York.

A few days before the arrival of the cubs at New York the late Edward H. Bean, then director of the Washington Park Zoo at Milwaukee, and later in charge of the famous \$5,000,000 Brookfield Zoo at Chicago, had wired his New York agent to buy a pair of polar bears. The New York agent had learned of the arrival of the four polar bear cubs, and, on Director Bean's revised order, purchased all four.

The four cubs arrived at the Washington Park Zoo on September 16, 1912, and were turned over to animal keeper Charles Stanke. He named the three male cubs Silver King, Clown and Borealis, and gave the female the name of Sultana.

Each of the cubs, nearly one year old, weighed about sixty pounds. The four were placed in a big den and got along nicely together. The great crowds that came to see them soon seemed to erase the cubs' memories of their native Greenland, and they quickly learned to entertain their thousands of human friends.

It was not until late in 1918 that Sultana began to show interest in raising a family. Animal keeper Stanke assigned Silver King as her mate, Sultana's preference for Silver King having been made apparent. The other two males, following an intuitive custom of polar bear habitat, accepted the arrangement without objection. Late in 1919 it became evident that Sultana was about to give birth to a cub.

Polar bears do not hibernate, except that the female goes into seclusion when she is to become a mother. Animal keeper Stanke provided a special den with plenty of bedding and food for Sultana and anxiously awaited developments.

Polar bear mothers stand near the head of wild animal mothers in devotion to their young. For about sixteen months, day and night, they remain with their cubs, which weigh about two pounds at birth. In the wild Arctic they allow no other animals to come near their offspring. They train their cubs to swim, fish and otherwise to make their own way in their rugged world. Once this training is over, polar bear mothers coldly turn away from their cubs and have nothing more to do with them.

On December 2, 1919, faint cries of a cub came from Sultana's dark, secluded quarters, but it was not until



March 20, 1920, that Sultana brought her first born to the door of her den.

Sultana's first cub was named Zero, and his mother trained him to swim in the den pool, instruction that greatly amused crowds of watching humans. Especially entertaining was Sultana's course in diving.

Sultana and Zero were formally introduced to Milwaukee on a Sunday in June, 1920, and 40,000 people attended the function. Zero was sold to the Longfellow Zoo at Minneapolis in May, 1922, and he died there on March 12, 1928.

That Zero was the first polar bear cub born in captivity to live was due to the alert care of Sultana, and the study and watchfulness of Director Bean and Keeper Stanke. When it was certain that Zero would reach maturity, congratulations poured in from zoo officials everywhere, including Dr. Chalmers Mitchell, of Regent's Park Zoo, London, England, and officials of the Smithsonian Institution of Washington, D. C.

Dates of arrivals of Sultana's twelve cubs were: December 2, 1919, Zero; November 24, 1921, twins, male Greely, female Niobe; December 2, 1923, twins, males Peary and Bob Bartlett; December 22, 1925, male, unnamed, sold to the Duluth Zoo; December 2, 1927, female, Nanook; December 12, 1929, twins, unnamed; December 10, 1931, female, Sultana II; December 11, 1933, male, unnamed; December 27, 1935, male, died in twelve days.

The first tragedy in Sultana's life came in 1920 when Clown, one of the three males captured with her by the Norwegian fishermen in 1912, was shot to death by a Milwaukee detective. Two hours after Clown had been separated from Queenie, his den mate, Clown climbed over a steel fence nine feet high surrounding his den and (Continued on page 442)

Clark's Nutcracker

By H. W. HIGMAN

EVERY summer visitor to the areas just below timberline in the western United States knows the Clark's nutcracker, or Clark's crow, *Nucifraga columbiana*. It is a bird built on tourist specifications—large enough (small crow size) to be watched without field glasses, noisy enough to reveal its position constantly, tolerant enough of people to visit camp grounds and to allow reasonably close approach, and active enough to amuse the crowd. It frequently poses in the top sprays of small alpine conifers, where its gray body, white-patched black wings, and black and white tail form a combination of color blocks that make it resemble a striking poster design.

When in the mood, these birds accept dole from the tourist. At such times a few salted peanuts often will bring a dozen of them down from nearby trees. They come close, but not in the confiding manner of the Canada jays. The nutcrackers are bold but wary.

At other times, presumably when pine seeds and insects are plentiful, the birds desert the camp grounds and leave the tourist offerings to the ground squirrels and chipmunks. There is much activity when a number of nutcrackers feed on a mountain hillside. The rear rank keeps drifting to the front, harsh calls sound frequently, and the contrasting color pattern of the birds flashes across the rock or snow background as they move along.

They named this bird Clark's nutcracker to honor

Captain Clark wrote of the bird that now bears his name: "I saw today (a) bird of the woodpecker kin which fed on Pine burs." It was the sleek bird shown above, and here, perched typically on the stump of a dead pine tree.

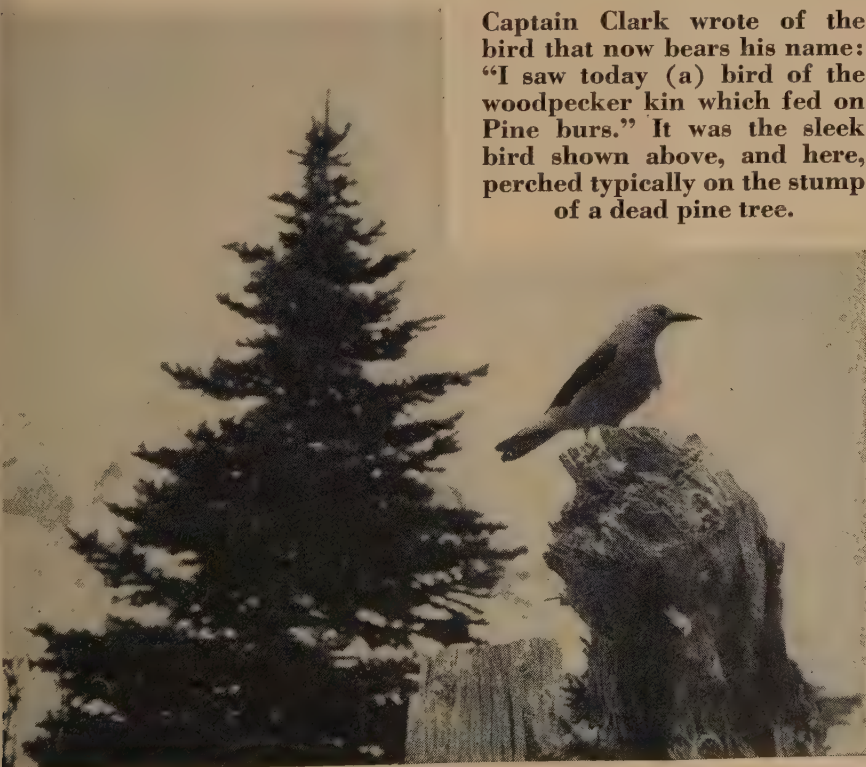


one of the leaders of the Lewis and Clark expedition. Captain Clark discovered it in August, 1805, the most critical and dramatic period in the history of that great journey. Oars, sails, cord, pole, and portage had brought the expedition boats from the mouth to the headwaters of the Missouri. Between them and the Columbia River, which they now sought, rose an unknown jumble of mountains. And in the background, unless a route was found at once, stood the threat of snow-blocked passes and failure of the expedition.

The leaders faced several urgent tasks—to determine whether a practical water route could be found, to obtain a supply of horses for transport if the party had to go overland, and to locate the nearest point on the Columbia where the water was navigable and canoe timber could be secured.

No time was wasted. Clark and the main party continued to force the canoes up a fast stream, so crooked that ten miles of river often meant only four miles of actual advance. Meriwether Lewis, with three men, scouted the country ahead. He drank from the headwaters of the Missouri, crossed the divide, and on the same day tasted waters that ran into the Columbia. He found the tribe from which Sacajawea, wife of a French interpreter of the party, had been captured when a girl. Lewis must have watched the reunion of the Indian woman with her brother with much satisfaction. He was a chief; the tribe owned many horses; the expedition's transport was assured.

Food became scarce, the men were foot-sore and bruised, and ill from the constant struggle with the river. But the expedition records were kept up. The journalists entered not only the important events but minor things as well—notes on the insects, fishes, quadrupeds, and birds. On August 22, 1805, (Continued on page 444)



The Georgian Oyster

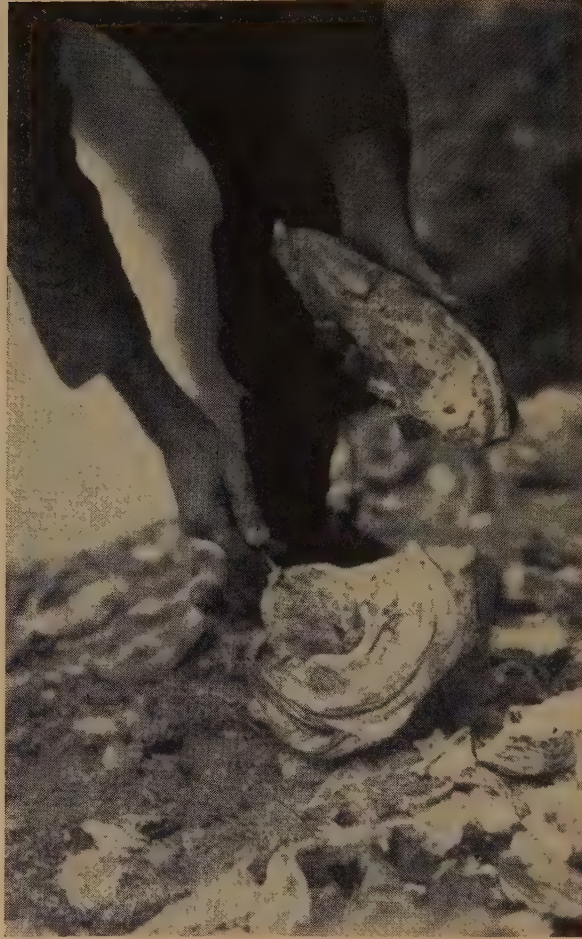
By IVAN R. TOMKINS

THE Georgian oyster may have been tasty and full of flavor; certainly it was amply large to suit anyone. Today, however, no one knows how it tasted, for no man ever had a chance to try, because it flourished and died in the Eocene, perhaps a million or so years ago. There is little accuracy or use in thus quoting time, except to give a vague idea of the immensity of it. It will be remembered that the Eocene was about at the point when many mammalian species first appeared in North America, according to the record of the rocks. Then the ancestors of the horse still had four toes, and the more primitive of the elephants were evolving in northern Africa.

Today the coast of Georgia bears many excellent oysters, but they are another and smaller species, and are known as *Ostrea virginica*, and even the largest individuals never approach *Ostrea georgiana* in size.

For years I had heard of these ancient and gigantic oyster-shells cropping out in a bluff more than a hundred miles inland from the present shoreline of the Atlantic, and occasionally one of our friends on the river craft would bring along some specimens to show. It was natural to grasp the first chance to go and see for myself.

The Savannah River runs down through cypress and gum swamp, nearly two hundred miles, if you follow its bends, from the Fall Line at Augusta until it meets salt water, then about twenty-five more before it empties into the ocean. In the main, the river bed is an ancient one, and has followed pretty much the same channel, with some local meanderings, for what seems like a long time. On the highlands back from the river there are terraces, level plains from ancient sea bottoms when the ocean stood for various periods at higher levels than now. There are said to be seven of them, showing recognizable pauses in the level of the sea during Pleistocene time; seven terraces between the Fall Line and our present coast line.



Two of the giant Georgian oyster of prehistoric days that may have been tasty, but no man knows.

On a crisp November morning we drove up from Savannah, and at various places could definitely spot a sharply ascending grade, the foot of it representing an old shore line. On ascending a few feet, there would be a level plain stretching on ahead, and we knew that here was another terrace. Some, of course, could not be certainly distinguished, due to stream beds or the indentations of the old shore line. When we left highway for a dirt road running out to the river, we stopped to look at a persimmon tree, fruiting six weeks later than it would down on the coast.

On top of Shell Bluff where it overlooks the River Swamp, the thought comes that this was once, in fact many times, an estuary, flooded with salt water, and that the flora and fauna have undergone many changes. The road winds down the bluff to the river edge through oak and hickory to the level of the cypress and gum. In the spring the scene would be different, with the

dogwood dominant in the woods along the bluff.

The bed of giant oyster shells lies buried under many feet of earth and rock, except where uncovered near the edge of the river. Similar beds have been found at equivalent locations on other rivers of the coastal plain, and it is likely that an old sea margin bearing these oysters was more or less continuous far to north and south, but the remains now lie mostly buried under sea-lain deposits of later times.

William Bartram visited this place in 1776, and has given us this account:

"Before I leave Augusta, I shall recite a curious phenomenon, which may furnish ample matter for philosophical discussion to the curious naturalists. On the Georgia side of the river, about fifteen miles below Silver Bluff, the high road crosses a ridge of high, swelling hills of uncommon elevation, and perhaps seventy feet higher than the surface of the river. These hills, from three feet below the common vegetative surface, to a depth of (Continued on page 444)



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

A Record-Breaking Sunspot Cycle

By ISABEL M. LEWIS

THE present cycle of sunspot activity, which dates from the minimum of February, 1944, and should last under normal conditions for about 11 years, will reach its peak of activity this year, possibly in August. In size and frequency of spots this cycle has already established a record. Although it is now only three and a half years from the beginning of the cycle, the three largest sunspot groups that have ever been recorded were seen on the solar disk between February, 1946, and April, 1947. One has to go back to January, 1926, to find a group comparable in size with the smallest of these three. Since photographic records of sunspots were begun in Greenwich in 1874 there has been no group comparable in size with these four outstanding groups, three of them within the one cycle appearing before the peak of maximum activity for the cycle has been attained.

According to the British scientific weekly, *Nature*, for April 19, 1947, the great sunspot group that crossed the solar disk between March 3 and March 17, and was again brought into view by solar rotation between March 31 and April 13, then even greater in size and more complex in form than at its first crossing of the disk, was the largest of the three record-breaking groups of this cycle. It was then estimated to have an area of 5400 millionths of the sun's hemisphere. (Multiply by 1.17 to change to millions of square miles.)

Observations made at the U. S. Naval Observatory and the Mt. Wilson Observatory indicate that although this group contained the largest single sunspot on record, the area of the group as a whole was not as great as that of the group of February, 1946. The third group of the cycle in size and of all re-

corded spots, or spot groups, since records have been kept, is that of July, 1946. Both the groups of February, 1946, and April, 1947, crossed the solar disk four times, the former being visible for 99 days and the latter for 96 days. The group of July, 1946, was visible for 43 days.

It is a most unusual fact that no great magnetic activity was noted in connection with the great sunspot group of March-April, 1947. Great magnetic storms usually occur on the earth within a few days before or after the passage of a great sunspot group across the central meridian of the sun, but not even a minor magnetic storm was observed near the time of meridian passage of this group. It is believed that the intense solar flares that appear in the chromosphere generally in connection with great sunspot groups are associated with the magnetic storms that appear on the earth near the time of their meridian passage. Solar observations made around that time indicate an absence of flares, or any special activity in the solar chromosphere in the vicinity of this group. It would appear that the magnetic storms on the earth at such times were induced by these intense solar flares in the chromosphere above these sunspot regions.

The U. S. Naval Observatory in Washington, D. C., and the Mt. Wilson Observatory in California are the two observatories in the United States at which observations of sunspots are made continuously. Records of sunspots have been kept at the Naval Observatory since 1898, but counts of sunspots were not started until 1938. Measurements of areas and positions of sunspots are made at this observatory, while group numbers are assigned to sunspots at Mt. Wilson, and records are kept there of the magnetic polarities of the groups. There, also, spectroscopic and other observations are made of sunspot regions and the phenomena occurring in the solar atmosphere above them.

The present sunspot cycle has been a record-breaker in more ways than in the size of individual spots or groups. On May 25, 1947, appeared the largest number of spots and spot groups ever recorded at the Naval Observatory in one day since recording of sunspots was started there. On that day, in 21 numbered groups, 403 individual spots or condensations were counted.

The largest total area involved in sunspots or spot groups on any one day since measurements were started at the Naval Observatory in 1938 was 7736 millionths of the sun's hemisphere. This was on March 7, 1947. Solar activity for this cycle was recorded as still increasing at Mt. Wilson in March and April. These are the last months to date for which the results of observations have been published in the

bi-monthly publications of the Astronomical Society of the Pacific. They show that sunspot groups continued to increase in number in these two months. The mean daily number of groups was more than 11 for each month. On April 10 and 12 there were 18 different groups observed.

Observations made during May at the Naval Observatory show a still further increase in the number of sunspots. As stated above, it was on May 25 that the count of sunspots at that Observatory was the largest ever made. It is possible that a still further increase in daily sunspot counts may occur during this summer. The date of the sunspot maximum cannot be exactly determined for several months yet, but there seems little doubt that it will occur late this summer or in the fall. The rise to sunspot maximum activity is much more rapid than the decline to the next minimum, and sunspots will continue to appear in large numbers for two or three years. During this period it would not be impossible for other spots of record-breaking size to appear. It is, in fact, true that sunspots of great size have occasionally appeared, even during a period of minimum sunspot activity.

Another feature of this most unusual sunspot cycle is the large number of spots that have been observable without telescopic aid. Naked-eye sunspot groups were visible, according to Mt. Wilson records, on one-third of the days in 1946, and on about one-half of the days in the first four months of 1947. A spot to be easily visible without the aid of a telescope should have an area of 3000 millionths of the sun's visible hemisphere, or more. Such spots would be called "great" and they are comparatively few in number. Spots do not have to be as large as 3000 millionths of the sun's hemisphere to be seen with the naked eye, however. That there should be so many naked-eye sunspots in one cycle is remarkable.

Sunspots are restricted in their appearance to well-defined belts on the solar surface. No spots ever appear in high solar latitudes, or within five degrees or so of the sun's equator. At the beginning of a cycle, spots of the old cycle, few in number, will be dying out within a few degrees of the equator, while spots of the incoming cycle appear in increasing numbers in latitudes 35 to 40 degrees north or south of the equator. As the time of maximum sunspot activity approaches, the sunspots tend to gather from 15 to 20 degrees north or south of the equator. One hemisphere of the sun is usually more active than the other. The great sunspot group of April of this year appeared in latitude 23 degrees south of the sun's equator. According to Mt. Wilson observations, the southern hemisphere of (Continued on page 436)

October Moon

By IRENE STANLEY

The moon is a ripe pomegranate
For anyone's picking tonight!
Whether poet or scientist scan it,
The moon is a ripe pomegranate!
A faraway burned-out planet
Of cold reflected light?
The moon is a ripe pomegranate
For anyone's picking tonight!

Camera Trails

By EDNA HOFFMAN EVANS

WHILE there is no great uniformity as to timing, school bells have been ringing throughout the country for the last few weeks, heralding a return to lessons for millions of Young Americans, after a summer spent doing whatever Young America finds to do with itself during vacation.

This being the case, another section of "Camera Trails" devoted to visual education—that is, the use of motion pictures, slides and filmstrips, and other "seeable" material in schools, ought to be timely. Last year's visual education section seemed to be well received and letters came from various parts of the country asking how, where, and when visual education material could be obtained. This section, then, is intended to supply such information.

Actually, the films and other material mentioned need not be confined to schoolroom use. Many of them are suitable for use by adult groups of various sorts—bird clubs, garden clubs, forestry, conservation, agriculture and others, as well as for youth organizations such as Boy and Girl Scouts, 4-H clubs and the like.

Possibly the best and most complete listing of educational films available is to be found in the seventh annual edition of *Educators Guide to Free Films*, published by the Educators Progress Service, Randolph, Wisconsin. This guide, which came off the press in July and which sells for \$5.00, is up-to-the-minute listing of both motion pictures and slide filmstrips, available simply for the borrowing, and for the payment of shipping charges either one or both ways.

This new seventh edition, compiled and edited by Mary Foley Horkheimer and John W. Diffor, contains much more material than any of its six predecessors. Indeed, the latest edition is nearly four times the size of the first guide, issued in September of 1941, and has forty more pages than the 1946 edition. Of the 1448 titles listed, 425 are new, while films withdrawn from circulation during the past year have been deleted.

This increase in size and number of titles is eloquent evidence of the way in which visual education has expanded within the last few years. Also included in the guide is a discussion of "The Free Film" by Dr. John Guy Fowlkes, professor of education and dean of summer session at the University of Wisconsin. Dr. Fowlkes states that "never since the advent of the McGuffey reader have the role and the means of educational informational material been as vitally influenced as they are being influenced today." That influence is—you guessed it—sound and motion picture photography.

But there are numerous other sources of visual material available for use by groups of various kinds. A listing of some of them follows:

1. Encyclopaedia Britannica Films (formerly Erpi), 20 North Wacker Drive, Chicago 6, Ill. The attractive catalog issued by this company lists 238 titles, covering a wide range of subjects—science, art, history, geography, mathematics and music—for various age groups. The bear cub picture used to illustrate this section is a "still" from one of this company's films, "Black Bear Twins," aimed at classroom use in primary science courses.

2. The Society for Visual Education, Inc., 100 East Ohio Street, Chicago 11, Ill., has a great deal of material available and publishes an attractive series of catalogs. It has an extensive listing of kodachrome slides, of educational filmstrips (some 1500



This adventuresome bear cub, shown climbing a tree in search of a honeycomb, is a character from "Black Bear Twins," a Britannica film for use in primary science.

of these) and of projectors, lenses, and other equipment needed for the care, maintenance and showing of visual aid material.

3. From the Victor Animatograph Corporation, which has its home office and factory in Davenport, Iowa, can be obtained additional material, especially addresses of film libraries located in the inquirer's part of the country. This company manufactures 16mm motion picture cameras and projectors.

4. Pictorial Films, Inc., RKO Building, Radio City, New York, which was mentioned in last year's section, recently completed a new production that will soon be particularly timely. This is a 100-frame colored slidefilm of Dickens' *A Christmas Carol*. It sells for \$9.75 per copy.

5. Motion Picture and Speakers Bureau of the Westinghouse Electric Corporation, 511 Wood Street, Pittsburgh 30, Pa., can supply a number of motion pictures and slidefilms, free of charge, except for the payment of transportation costs.

6. This final listing is a negative one. The United States Department of Interior, Division of Information, Washington, D. C., formerly supplied visual aid materials but a query in preparation for this section brought only a boilerplate reply that the department's service had been "discontinued for the duration." (How long, oh Lord, how long?)

Of course there are numerous other sources of visual aid material and non-inclusion herein is the result of lack of space rather than of any form of intentional discrimination.

Now for a few personal remarks on the subject of films for schoolroom use. Some are excellent, others mediocre, and a few (personal opinion, of course) actually harmful. As an example of this latter we can recall one film entitled "Our Heritage," produced by the Florida Game and Fresh Water Fish Commission. The aim, apparently, was conservation, for the young hero was lectured mildly on the subject of not shooting does—does produce fawns and some fawns grow up to

be buck deer which can be shot. Also, a restocking program of fresh water fish was shown.

But what made our blood boil was the exciting sequence showing a panther hunt in the Everglades. Granted the few panthers left may make occasional raids on chicken yards, but what the youngsters viewing the film remembered was not the conservation of deer or fish, but the long and thrilling hunt for panther, climaxed when the gallant hunter dispatched the animal. It was



Our old friend Scrooge appears in new guise in the 100-frame slide-film of Dickens' *A Christmas Carol* recently produced by Pictorial Films, Inc.

truly a difficult shot. The gunner stood at the foot of the tree and fired at the graceful big cat, silhouetted against the sky in the dead branches above his head.

Maybe Florida panthers deserve killing—we have never faced one nor have we had to compete with it for the bare necessities of life—but panthers are getting rare and we deplore the destruction of any rare animal, plant, or bird. “Kill” rather than “Conserve” was the thought implanted by that movie—and how can “Our Heritage” be preserved in such a manner? We are glad the Florida panther’s last haunts are now in the process of becoming Everglades National Park.

And now a word of praise for the animators. Walt Disney may mean Mickey Mouse, Donald Duck or Snow White to the average adult moviegoer, but the job his studios, and others, have done in animating educational movies is admirable. Whatever the camera cannot show from Nature, the animator’s agile pen and brush can bring to life on the screen. We recall one on the hybridization of corn, wherein the lady corn stalk (very dainty and feminine) joined hands with the gentleman cornstalk (very virile and vigorous), and then, to the tune of “Rock-a-bye Baby,” a much better hybrid species grew up before the eyes of the audience.

It takes more than film to run a movie, be it silent or sound, a filmstrip or a series of slides. A projector is necessary, either 8 or 16mm, preferably equipped for sound. Silent films can be shown in sound projectors, but sound cannot be produced by silent projectors.

There are numerous “still” projectors—some able to show either slides—which are flat squares, usually 2 by 2 inches—or filmstrips—which are a series of still pictures printed on 35mm film. Sometimes a phonograph record, containing a commentary explaining the picture, may be used simultaneously. This latter combination is known as sound slidefilm.

Projectors, screens, film patching and editing apparatus, and repair parts may be obtained from numerous sources, and a visit to any up-to-date camera store will be informative, entertaining, and possibly bewildering, due to the diversity of types and prices of equipment available.

A few of the companies producing such material are listed, and a card or letter to any of them will result in catalog, booklets, and possibly a personal call from the company’s nearest representative. Mention *Nature Magazine*.

1. Bell & Howell Company, 7100 McCormick Road, Chicago 45, Ill.

2. Eastman Kodak Company, Rochester 4, New York.

3. Victor Animatograph Corporation (mentioned above).

4. Argus, Inc., Ann Arbor, Michigan.

5. Burke and James, Inc., 321 South Wabash Avenue, Chicago 4, Ill.

6. Bausch & Lomb, 635 St. Paul Street,



Nobody would object to going to school if a teacher like this was in charge of the visual education. She is using a Bausch and Lomb 2 x 2 slide projector.

Rochester 2, N. Y.

7. Bolsey Corporation, 118 East 25th Street, New York City (for film splicing and similar supplies).

SUCKER BAIT

Due to lack of space this time (we get enthusiastically long-winded about visual education) we are going to skip the trade notices that have come in during the summer, reserving some for use later on, especially in the “Christmas shopping” section we are planning for December.

But we cannot help mentioning (without calling names) the ad that arrived recently. Barnum probably was right in saying that “there’s a fool born every minute,” but he should have added there’s a scheme perfected with equal rapidity to separate that fool from his money. The ad did not come to us in our “official” editorial capacity, so our name must be on somebody’s sucker list. We readily admit the sucker, but we do resent being listed as such.

The ad we refer to is a card in the form of a punchboard, with twenty places to be punched. Four “lucky” punches cost smaller amounts while the rest cost 29¢ each. The total is \$4.99 and after the recipient has either punched them all or imposed them on his friends, he sends in the total and receives two candid cameras and a billfold.

Since our childhood disappointment at not being able to sell the required tank-car full of perfume in order to win a real, live pony still rankles, we hope “Camera Trails” readers will not fall for this figment of some publicity man’s imagination. We do not approve of punchboards, and if the reader has \$4.99 to waste on camera equipment, he will be wise to spend it on a recognized make from a standard dealer.

SUNSPOT CYCLE

(Continued from page 434)

the sun was much more active than the northern hemisphere in March, when 63 groups appeared south of the equator and only 35 groups north of it. The distribution of these groups over the solar disk was wider than would be expected at a time so close to the time of sunspot maximum, if it is to occur this summer or fall. Sunspots were visible from 31 degrees north to 42 degrees south of the sun’s equator. There was a spotless belt from 10 degrees north to 4 south. Why sunspots never appear at the sun’s equator, or more than forty degrees or so north or south of it, is not clear. There are, in fact, many peculiarities of sunspots that have not yet been explained, but an understanding of which may be attained before long.

In October no planets will be seen to advantage in the evening sky. Mercury will be farthest east of the sun on October 13, but the ecliptic, near which its path lies, is at this time of year so close to the horizon that the planet is most unfavorably placed for observation. Venus, also in the western evening sky this month, is still too close to the sun to be seen to any advantage. It will be in conjunction with Mercury, low in the southwest, on October 29, but it is doubtful if the planets can be seen so close to the horizon in the haze of twilight.

Mars now rises soon after midnight and is near the meridian at sunrise. It lies about half-way between The Twins in Gemini and Regulus in Leo the middle of October. Saturn, which rises after Mars, is between Mars and Regulus at this time. The two planets can be easily distinguished by their characteristic colors, Saturn a pale yellow, and Mars reddish. Saturn is also the brighter of the two planets at this time.

Jupiter is still in the western sky, but is near the horizon in the early evening and sets about an hour after the sun the middle of the month.

Movie Contest

Announcement is made by the American Humane Association, 135 Washington Avenue, Albany 6, New York, of its 1948 amateur motion picture contest for movies of pets, domestic animals, birds and wildlife. The contest closes March 31, 1948, and full details, including entry blank, will be mailed on request to the address above.

Geography Meeting

The National Council of Geography Teachers will hold its annual meeting in Charlottesville, Virginia, December 27-29. Besides the sessions, there will be a field trip through the Piedmont and Blue Ridge mountains.

THAT VIBRANT HUSH

By DOROTHY HURD

I was weather observer in Lander, Wyoming, on the night watch. All night long the wind had been blowing the corners off the building, and banging its fists on the stovepipe until the soot fell into the room and drifted in the corners like snow. At sunup it increased in fury. When I went out to read the five o'clock temperatures, the velocity measured 53 miles per hour; walking was difficult, and the sand stung my face and bare legs.

I thought of the birds that, every other morning, had sung joyously, making even the "mid watch" a delightful experience. I wondered where they were on such a wild morning, and pictured the poor meadowlarks clinging to the sagebrush with both hands, their feathers pasted down tight. And then the most wonderful thing happened.

The stovepipe stopped shaking, the howling stopped and all was quiet. The whole world held its breath. The ticking of the clock and the triple register were heard again in the room. This was the vibrant hush that thrills the concertgoers as the conductor taps on his rack and raises his baton. Then the first full chord of the orchestra rose from the sagebrush and soared to the blue sky. A great warbling, trilling, carolling, and chirping of grateful little bird hearts filled the air and I knew the wind would not return. It was again a summer morning in Wyoming.

Cheese-eating Mocker

From Venice, California, Frances L. Reynolds reports a mockingbird with a staunch appetite for cheese. He turns up three times every day for his ration of American cheese. He disdains Swiss. Occasionally the bird will accept a bit of tamale, one day ate some chili beans, and relished some hamburger left over from a barbecue—all this despite the fact that there were plenty of insects around. When the mocker's wife arrived, Mrs. Reynolds speculated whether there would be a family raised on American cheese—and at the present prices!

Great Barrier Reef

Wonders of the Great Barrier Reef. By T. C. Roughley. New York. 1947. Charles Scribner's Sons. 282 pages. Illustrated by 52 natural-color photographs by the author. \$5.00.

The Great Barrier Reef of Australia is one of the great natural wonders of the world, noted for the interest, variety and beauty of the life it contains. Nature has done things there that she has not duplicated elsewhere in the world. Thus this entertaining book by a distinguished naturalist of New South Wales makes fascinating and surprising reading.

Bloodhounds

Bloodhounds and How to Train Them.

By Leon F. Whitney, D.V.M. New York. 1947. Orange Judd Publishing Company. 142 pages. Illustrated. \$2.00.

Although this book is directed mainly for those who keep bloodhounds for their usefulness, people like policemen and private detectives, it is likewise of interest to anyone who keeps these dogs for other reasons.

For Bass Fishermen

Striped Bass. By O. H. P. Rodman. New York. 1947. A. S. Barnes and Co. 69 pages. Illustrated. \$1.50.

Bass Bug Fishing. By Joe Brooks. New York. 1947. A. S. Barnes and Co. 69 pages. Illustrated. \$1.50.

These two little books are recent additions to the Barnes Sports Library and their titles are amply indicative of the audience to which they appeal.

Igneous Minerals

Igneous Minerals and Rocks. By Ernest E. Wahlstrom. New York. 1947. John Wiley and Sons. 367 pages. Illustrated. \$5.50.

This book is a result of the author's discovery of need for "a book that will serve the ordinary requirements of a beginning student in microscopic igneous petrography, and, at the same time, will lend itself conveniently to use by more advanced students who frequently or occasionally wish to classify igneous rocks by microscopic methods."

Yosemite Broadleaves

"Yosemite Nature Notes," publication of the Yosemite Naturalist Department and the Yosemite Natural History Association, devotes its January, 1947, issue to a forty-page, illustrated pamphlet entitled "Broadleaved Trees of Yosemite National Park." This is written by C. Frank Brockman, and treats with the eighteen broadleaved trees of the Park, each one pictured. The booklet sells for 25 cents.

The Timber Budget

"Balancing the Timber Budget in the Bumper Belt" is the title of an excellent little booklet published by the Agricultural Development Department of the Baltimore and Ohio Railroad, Baltimore 1, Maryland. It is designed to give effect to the forest conservation and reforestation program of the railroad, which seeks to insure the permanence of the existing privately owned woodlands and to increase their productivity. The booklet preaches the important doctrine of sustained yield management of such wooded areas.

FIR SEEDS FLY HIGH

By HAROLD OLSON

How high and far do Douglas fir seeds travel? E. F. "Cap" Wade, timber cruiser for the Washington State Department of Public Lands, has something unusual on this question. One day in late September, 1944, Wade flew from Quillayute Prairie, Washington, to Portland in a two-seat naval plane. The pilot was Lieut. Commander Robert N. Dobbins, commander of Quillayute naval air base. It was a hot day, and Wade had noticed the fir seeds were dropping up on the Olympic peninsula.

"We flew down the coast and up the Columbia River," said Wade. "We were somewhere in the vicinity of Wickiup Mountain, coming up the Columbia at 5000 feet altitude, when we noticed something striking the canopy with sharp clicks. It appeared to be fairly solid matter but it wasn't bugs. There was no splattering, and we were doing 200 miles an hour or more. We flew through a sort of shower of the stuff for a minute or so. I got to wondering what it was and so did Commander Dobbins. When we landed in Portland we looked over the plane's outside surfaces. We picked off about a dozen Douglas fir seeds."

Wade, a cruiser of 30 years' standing and an engineers' captain overseas in the first World War, is convinced they flew through a storm of fir seeds caught in a strong updraft and carried perhaps miles from their origin. It would be feasible, he thinks, for a whirlwind to pick up the winged seeds from one or more trees on a day like that when the cones were opening and seeds falling.

"This might explain, at least in part," he added, "some puzzling reproduction that has come in on hard-burned areas too far from seed sources to get any by ordinary action of the wind. They tell me seeds won't travel much more than a half mile under average air conditions."

Wade predicted that "one of these fine days someone else is going to run into the same thing."

Certain Game Animals Increase

Marked increases in the number of big-game animals dwelling in the 152 national forests of the country are reported by Lloyd W. Swift, chief of the Division of Wildlife Management of the U. S. Forest Service. For example, 25 years ago the estimated number of deer in these areas was 450,000. The present population is estimated at 1,992,000. In the same period elk have increased from 52,000 to 160,000; antelope from 2400 to 27,000; moose from 3600 to 9500; black bear from 37,000 to 74,000. Protection and improvement of habitat are credited with the increase. The only sad feature is the decline in bighorn sheep from an estimated 13,000 in 1921 to 9000 in 1946.

The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

DOWN TO EARTH

ALTHOUGH I am approaching the three-score-year mark, I spent a most important half hour, one recent afternoon, flat on my stomach in the middle of a well-travelled sidewalk. Students, college professors, and laborers stepped over my feet and walked around me, but none stopped to pick me up. I was not "out cold," merely enjoying myself thoroughly showing a class of students the habit pattern and reproductive story of a colony of digger wasps that, for years, have used the sand and cinder "fill" at the edge of the sidewalk to carry on their lives.

These wasps may live in colonies, but each maintains his independence, which is not a bad idea for a social order. When the time comes for the female to lay her eggs, she digs a burrow about six inches deep and about the diameter of your index finger. She then goes off on a little hunting trip and eventually returns with an insect fully as large as she is herself. In the case we were watching the prey were a type of meadow grasshopper. The catch is dragged to the entrance of the burrow, then the wasp goes underground apparently to see if everything is in readiness to receive the grasshopper, which she has stung and partially paralyzed. She quickly returns to the entrance and drags the grasshopper underground. On it she lays an egg, which, relatively soon, develops into a grub. This, with remarkable rapidity, consumes the grasshoppers that the mother wasp has stored away.

The rest of the story is more or less typical. It might not be worth telling here except for the fact that we introduced a new factor into that wasp's pattern of existence. While she was underground we turned the grasshopper around so that its head was away from the burrow. When she came up she had to straighten the grasshopper around, and, when that was done, she felt she had to go underground again before dragging the grasshopper down. While she was down the second time, we turned the grasshopper around again, and again she had to straighten it around after her underground trip. It would have been the simple and sensible thing to take the grasshopper down, once it was headed in the right direction, but that was not in the habit pattern.

I tell this story not for itself on a school page, but because of other things that happened during this laboratory experience we were having outdoors. I could tell of the small parasitic flies that we saw perching on nearby grass. Once a grasshopper has been taken underground these flies may enter the burrow and lay an egg on the grasshopper just as did the wasp. Unfortunately for the wasp, the fly larvae develop even more rapidly than do the wasp larvae, and so the wasp larvae find the cupboard bare when they are ready for a meal. I suppose a lecture on that point would have been in place, and I did point it out, but other things happened that afternoon.

The stretch of territory in which the wasps were living was at least seventy-five feet long. While we were watching the wasps at one end of the line, a couple of robins were watching at the other. As soon as a wasp would bring in a grasshopper and leave it at the burrow entrance, a robin would hop up and eat the grasshopper. So all of us—students, professors, wasps, robins

and parasitic flies—were interested in the continued stream of grasshoppers the wasps could supply to satisfy our needs.

But can we roughly classify the humans who were in this picture just as professors and students? Let's see. While we were watching what was happening a professor of entomology came along. He offered the rather startling information that one of his graduate students had marked these wasps, and had had one that turned the grasshopper around twenty-nine times before finally giving up the effort. The professor then went on about his business. We set out to see if we could not duplicate the record. The first wasp we worked with gave up and flew away, leaving a partially paralyzed grasshopper after we had fooled it just a few times. We did not like to waste that grasshopper so we put it beside the entrance of a wasp burrow that seemed just about completed. We did this while the wasp was underground. When she again came up into the light of day she grasped the grasshopper and stung it vigorously. The simple thing now would have been to take the critter underground, but, after stinging this gift, the wasp took to wing with it and flew back and forth over our heads, only to settle eventually at the entrance of the very hole she had left.

Now the fun began. While she went underground one of us turned the grasshopper around. She came up, turned it around again and went underground. This was repeated until it got tiresome. One student kept a record of the number of times the wasp went underground, and when one student got tired of turning grasshoppers another took over. As the number approached the twenty-nine that we had been told was a record, we began to get a little excited, and when it went to thirty-one we let out a cheer. At this point the wasp tried a new wrinkle. It took the grasshopper for another ride, and then set to work

at the same old pattern. We decided to see whose patience would give out first, and kept turning until we had reached a total of fifty-nine. At that point the student charged with turning the grasshopper was a little slow, and the wasp returned and drew the grasshopper underground before the change was made. All of us felt that she deserved the break she got.

But that is not all of this story either. We saw grasshoppers, wasps, parasitic flies, robins, and we gave students an opportunity actually to try to upset a simple habit pattern. I hardly think that that lesson to more than a score of students was the most important thing that happened that afternoon. In the midst of our observations a student who was not a member of the class stopped to see what we were doing. She was immediately interested in the wasp and asked me if I would care if she collected it. I misunderstood her and thought that she asked if I cared if she watched what we were doing. She almost had our wasp in a collecting jar before I stopped her. She explained that she had had twenty hours of entomology and therefore, presumably, was entitled to particular consideration when it came to collecting wasps. I showed her where another student had marked this particular wasp with a spot of dye, and explained that he was interested in the living animal. It seemed only fair that if she must collect that she collect some animal that was not helping a poor student get his doctor's degree. She agreed to this and stayed by us through the whole experience. As she left, when we moved on after the wasp had outworn our patience, she turned to me and said: "Do you know, that is the most interesting lesson I ever had in entomology."

Frankly, I think that if I did nothing else that afternoon my time was well spent if I showed someone who did not have to study under my direction that living things can teach more and better lessons than dead things.

I wish I could convince a few of the leaders in the field of science education of this fact, but apparently they enjoy throwing around generalizations whose significance they cannot possibly appreciate. Marsh, the paleontologist, once tried to get his students to get their bodies (Continued on page 439)

Enough

By FRANK WALLACE

The glowworm's ego shines
Irradiant in the night;
The sun's help he declines
For his own little light.

THE SCHOOL PAGE

(Continued from page 438)

close to the earth to learn from it, and suggested that, at least once a day, they should get their eyes within a half a foot of the ground. He came back and found them all flat on their backs with their eyes shut. Technically they were following his directions, but, of course, they were not following his leadership. I rather think that in much of the science and nature work we have in schools we are following some routine almost as fixed as the one followed by the wasp. We just cannot get out of the beaten path. As one youngster, in a State Regents' examination, said of a given experiment, it could not be following the scientific method because its directions did not list the object, materials, method, procedure, tentative conclusion and conclusion that happened to have been followed by his teacher in some of his lessons.

As teachers we no doubt criticize regimentation in governments, at least in governments other than our own. We question the merit of ritual, of learning by rote and of the techniques of indoctrination; but most of us stick pretty close to that system when it comes to our teaching.

I do not care who you are, or where you live, it might be a good thing for you to lie flat on your stomach on a sidewalk for a half hour and see what you can learn there. I did not lie that way just to be different. I did not think anything about it at the time except that it made it possible for me to see better what was going on. Probably if I had stopped to think that I was a college professor I never would have been so undignified, but that is one of the nice things about teaching from Nature in the raw. You always find that there are so many things that you do not know, and want to know, that you have no time to be pompous.

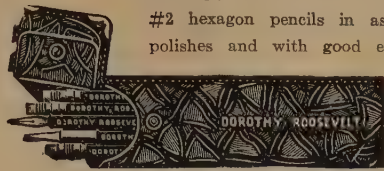
I'm willing to wager that if you ask any of those students who were with me that afternoon about the habits of those wasps they will be able to tell you the details for the next twenty years. Furthermore I will wager that they will *want* to tell about those experiences, and will be just a little more interested in the study of habits of living things in general. When they begin to study their own habits, then I will be satisfied, because then they will, I rather think, begin to improve themselves.

I only hope that if you do lie on your stomach on a sidewalk you do not get arrested or fired by your superintendent. The best defense against such a possibility is to get your critic so interested in what you are doing, that he, too, will want to get down to earth in this education business.

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SAUCY, BLUEJAY TYRANT

(Continued on page 404)

annoyance. Pinky does object, however, to being startled out of a sound sleep by Saucy's shrillest scream, which she directs into his ear. He bounces up and dashes for safety, but then, wide awake, he realizes that he has made a fool of himself, so he lies down and goes back to sleep.

I am certain that Saucy understands many words. She will get a button from one of her ingenious hiding places when you insist on it. She is most familiar with the word "peanut". This means, to her, two peanut kernels nicely shelled and held out for her consumption. Try giving her one kernel, and you will have to comb your hair, and possibly put some iodine on a few pecked fingers. This may also prove that she can count up to two. She knows the words: bath, Pinky, flies, fly, bug, rice crispy (which she loves), get out. This will send her flying in retreat, but she will soon scream her defiance from some convenient perch. She also knows our names, and the names of the flying squirrels—Fatty and Baby—which she hates. She will whistle and sing sweetly to entice Fatty or Baby out of their box, and then try to knock out an eye. Candy means a kind of fudge, which she insists on whenever she has performed some highly commendable act. "Goodbye" is the word that we use to induce her to behave, for this means that we are going to go out and leave her alone, and she hates anything like that to happen.

With her bill Saucy can knock pieces out of door corners that really make a noise when they hit the floor. She has dug one hole almost through the wall of the house to provide a safe deposit box for her precious peanuts and buttons. Her greatest masterpiece was the bank deposit robbery, which she conducted flawlessly, hiding every penny of her loot—amounting to more than one hundred dollars—in less than five minutes flat. Her life work is putting things away in safe hiding places. Peanuts, buttons, hairpins, even her personal fortune of \$3.90, are carefully hidden.

Saucy has her own studio, the bathroom, where she has carved the woodwork of the doors and window beyond repair. At least four inches of the door of the linen closet have been removed and carefully rounded off to suit her artistic taste. The window sash is peppered with holes, which conceal the loot of two years of household robbery. It is in these strongholds that we search for missing items. The bathroom serves a dual purpose; it is easy to clean, and a few papers, scattered under her favorite perches, take care of sanitation. She seldom soils our hands or clothing, although at times a chair or rug may suf-

fer, if the bathroom door is closed. Otherwise, Saucy retires at strategic intervals.

Saucy is an actress, and almost a ventriloquist. Her clear, high-pitched whistles can be plainly heard on the street. At times, some of the local Cinderellas suspect a "wolf" and not a bluejay as the source. She loves to answer the telephone, and she will chitter into it, if we hold the mouthpiece near her. She prefers to eat out of our mouths; we chew the food, she swallows it. This is the result of the injury to her bill, when she was fed almost entirely in this way. Now, however, she wants to reverse the procedure, and often she tries to feed us a nice shiny spider, or a mangled fly.

Saucy eats breakfast with the family, then she has her bath. Afterwards, music and the serious business of hiding things take up the rest of the day. She spends hours whistling sweetly. Her voice is lovely when she is happy, and, at rare times, she sings what can pass for a lovely song. She also has a sad song, a dirge that she reserves for periods when she has been slighted or wants sympathy. She has several distinctly different calls. Her scream of hate cannot be misunderstood. Her call for attention to some fine and noble deed, such as taking a bath, or puncturing a bagful of sugar, must not be ignored. She also has a cry that she reserves for the cat. This can be friendly or sarcastic, and it is not difficult to decide which meaning she intends.

I suppose Saucy is a member of the family forever. She will not fly out of open windows. Once, when she was a youngster, a big cock robin chased her on my neighbor's roof, so she will have nothing to do with the outdoors. She hates other birds, even other bluejays. She thinks she is part human, and she wants no traffic with the lesser species, now. Gradually, I have gotten used to living without buttons, losing my watch, and having a bird sail through the room. Somehow, I can not believe that Saucy has not always been with me, and I know that life will never be the same when she is gone.

"TERRAPIN TOWN"

(Continued from page 408)

ment, we shipped 50 terrapins to a certain foreign country for stocking purposes. In due time we received a letter of appreciation from the foreign official to whom the shipment had been consigned saying that now he could well appreciate the great fame of the American diamond-back terrapin as a rare delicacy because the ones we had sent him made such an excellent soup!"

None of the diamond-backs grow large, as the median line of the lower shell seldom reaches eight inches in length.

The animals that go to market are nearly all females because the males do not grow large and are of little commercial value. They rarely exceed a length of four and three-quarter inches while the standard for salable females in most markets is six inches. In the terrapin world there is no doubt as to which sex is the mightier.

The experiments at Beaufort have demonstrated that terrapins can be grown in confinement nearly as readily as chickens. If ordinary care is taken, a great many of the dangers that beset the wild terrapins can be removed. The impounded animals can be given food in abundance and at regular intervals, the depredations of natural enemies such as minks, rats, and seagulls can be reduced, and a safe place for hibernation can be provided.

Fortunately, from a commercial standpoint, a ratio of only about one male to six females has occurred among animals grown in captivity. Such a sex ratio is excellent for breeding purposes because it insures a high degree of fertility of the eggs.

The operation of private terrapin "farms", or coastal storage and feeding pens, was a profitable enterprise prior to World War I. One of the first of these was the Barbee Terrapin Farm, near Savannah, Ga., established in 1898, where a considerable quantity of terrapin has been canned in the past. Most of these terrapin farms, however, consisted of pens, often called "crawls", in which the animals were placed and fed in order to gain growth or merely to be held for a better market.

During and since World War II the demand and market value of diamond-backs have been increasing. In 1946 they were reported to be selling for \$72 a dozen in New York City markets. This accelerated demand may again justify the establishment of terrapin "farms" in southern coastal areas where a cheap supply of feed—trash fish and crab scrap—is available, and where favorable conditions exist for the breeding and growth of this aquatic turtle, which has been saved from extinction by the development of practical methods of artificial propagation.

Conservation in Action

This is the group title of a series of booklets to be issued by the U. S. Fish and Wildlife Service, the first of which is entitled "Chincoteague, a National Wildlife Refuge." It is a description of this refuge and its place in the migratory waterfowl conservation program. Written by Rachel L. Carson, the booklet has, therefore, a readability beyond that of most Government bulletins. Copies are available from the Superintendent of Documents, Washington 25, D. C., for fifteen cents.

Northern Canada and Alaska

Raw North. By Charles E. Gillham. New York. 1947. A. S. Barnes and Co. 175 pages. Illustrated by line drawings and end-papers by Bob Hines. \$3.75.

In this book Charley Gillham has written a rambling, realistic story—in places almost too much so. An occasional year-date shows that the episodes treated occurred within the past twelve years, of which seven have been spent by the author in the North. Somewhere Charley disclaims any purpose to let the book be considered historic, and perhaps this resolve struck in, and resulted in few dates. However, the whole book is very interesting and the author's usually carefully written descriptions of his own impressions are so interesting that we find it difficult to mention what to us is the one fault of the book—a fault that, to be sure, Charley has mentioned in his introduction. We fear that he has injected into many of his chapters too much profanity for the general good of the book. We are not squeamish, and those of us who have gotten around much know all the words that would better be printed sparingly. Such writers as Charley Gillham have no trouble in giving expression to their views without this kind of elaboration, and some friendly editor would have done well to cut out a few dozen cuss-words. We are especially impressed with this conclusion by reading the splendid and "realistic" penultimate chapter, Alaska Game. The story of the unparalleled wealth of North America's original wildlife, and of the depths to which a hundred years of exploitation by "civilized" man has sunk it, can hardly be surpassed and this chapter has no cuss-word in it.

E. A. P.

World Discovery

Discovering Our World. By Wilbur L. Beauchamp, Mary Melrose Williams, Glenn O. Blough. Book One for Grade 4, 224 pages, \$1.48. Book Two for Grade 5, 256 pages, \$1.52. Chicago. 1947. Scott Foresman and Company. Illustrated in color.

These books are in the Basic Studies in Science Series designed for use by middle-grade youngsters. Each volume is organized into units covering broad aspects of everyday environment and employing picture-method techniques used for lower grades and adapted to middle-grade science-learning problems.

Pocket Insect Book

An Insect Book for the Pocket. By Edmund Sandars. London. 1946. Oxford University Press. 349 pages. Illustrated by 36 color plates and in black and white.

This handy little book deals with British insects, is of partial application to the United States, and suggests that a similar book might find a welcome audience in this country.

Cornell Plantations

The Cornell Plantations—A History. By Ralph S. Hosmer. Ithaca, New York. 1947. Cornell University. 209 pages. Illustrated. (Available at \$3.00 from the author at 209 Wait Avenue, Ithaca, N. Y. Professor Hosmer is acting as factor for the Administrative Committee of the Cornell Plantations in connection with the sale of this book.)

This is the history of the growth and development of an idea. It is the story of the creation of an arboretum from earlier desires for available plant material, for botanical material, and for enhancement of the beauty of the Cornell campus. Publication of this history is made possible through the generosity of Robert E. Treman, whose father, the late Robert H. Treman, was largely responsible for the preservation, development and maintenance of many of the scenic advantages in and around Cornell and the City of Ithaca. Professor Hosmer, who is Professor of Forestry Emeritus at Cornell, has written a fascinating history of particular interest to Cornellians and to botanists.

Rock-bound Coast

Along the Maine Coast. Pictured by W. N. Wilson with text by Dorothy Mitchell. New York. 1947. Whittlesey House. 97 pages. With 6 color plates and 27 black and white water colors and end maps. \$3.50.

Any lover of the rocky coast of Maine—and who does not love it having seen it?—will revel in this lovely book. W. N. Wilson is a noted marine artist who has for many years been recording on canvas the beauties of this region. Six of his color paintings and twenty-seven smaller sketches dominate this book in a sense, but Dorothy Mitchell's text is an effective and entertaining foil for Mr. Wilson's pictures.

Exotic Fruits

Tropical and Subtropical Fruits. By B. E. Dahlgren. Chicago. 1947. Chicago Museum of Natural History. 72 pages. Illustrated by Albert Frey. Fifty cents.

All our cultivated fruits of the northern temperate zone are of Old World origin. Many of the fruits of the tropics and the subtropics also originate in the Old World; others are native to the Western Hemisphere. In this most recent addition to the popular series of botanical publications of the Chicago Museum of Natural History, Dr. Dahlgren treats with some sixty-five tropical and subtropical fruits, twenty-eight of them that came from across the seas. Text that accompanies the drawings by Mr. Frey is brief, but sufficient to guide one to further botanical exploration if desired.

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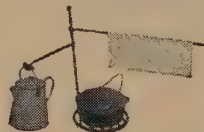
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THE ROSICRUCIANS
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MUMS WHEN YOU WANT THEM

(Continued from page 411)

blossomings in a year instead of one are produced, and a year has been saved in the usual breeding time.

Dr. Stuart explains that the light technique does physiologically what it would be extremely difficult to do genetically. But if there are other genetic problems besides late blooming to be solved—and of course there are many—then the lights can be used as a time-saver.

There is still a question left. Why does the midnight lighting delay blossoming? No one knows. Perhaps there is a new unsuspected "flowering hormone" that functions at night. Perhaps it builds up slowly after sundown, reaches a maximum quantity about midnight and disappears after dawn. If this were true, it would explain why the midnight light is more effective than lights at either end of the night.

Working on the assumption that light destroys this hormone, the midnight lighting would be expected to be most effective, even though the plants were exposed for a shorter time at the middle of the night, than at either end of the night. This is because too little of the hormone developed shortly after dark, to be much affected by light at that time, while by night's end the hormone has done most of its work.

So far, the mysterious 'mums have the experts baffled. Dr. Stuart comments, "We are truly working in the dark!"

MAGNETIC ANTS

(Continued from page 415)

the insects live. This grass is collected when the wet season starts, and green shoots are plentiful and are stored for use in the long dry period in the upper half of the nest only. Here it is, of course, safe from flood level.

The *Hamitermes meridionalis*, as these interesting termites are known to entomology, apparently cannot stand heat. During the middle of the day they seek the galleries at the base of the mound, or go beneath the actual nests. In the winter, when some warmth is required, they use the eastern side in the morning, and move with the sun to the western side in the afternoon.

Gopher Snakes

Bulletin No. 22 of the Zoological Society of San Diego deals with the classification and ranges of the gopher snakes in the western United States. It is the work of L. M. Klauber, and is of special interest to herpetologists.

LEE PASSMORE

(Continued from page 414)

laugh. "No, there are no sidewinders or scorpions running loose in my study, so have no fear."

"One more question, please," I said, rising. "You follow this work because you love it and find happiness in sharing your knowledge with others, I know, yet, I feel sure that it must hold some deeper significance. In your scientific researches what one thing has impressed you most?"

"The oneness and universality of life," he said, after a moment's reflection. "From the microscopic organisms that float by countless billions in every sea and in the air, on up to this complex organism that thinks and reasons, there appears a striking similarity. All live by the same systematic order and are activated by the same cravings for food, for mating and reproduction. Before Nature's daily miracles all about me, I bow my head in awe and reverence."

SULTANA, POLAR BEAR QUEEN

(Continued from page 430)

invaded a thickly populated section of Milwaukee. The detective's bullet ended the chase after a posse of zoo employees led by Director Bean, and squads of police, were unable to recapture Clown, whose mounted head decorates a wall in the zoo general office building.

There were several important events in Sultana's life. Silver King, her first mate and father of her first seven cubs, died of rheumatism in 1929. In 1930, Greely, the killer, Sultana's second son, killed his twin sister, Niobe. In 1935, Greely tore a foreleg off a black bear, which had to be destroyed. On April 10, 1939, Greely, aided by two brothers, killed Borealis, Sultana's second mate and father of her last five cubs.

Greely did not pay for his crimes with his life, but in 1940, Dr. P. F. Swindle, of Marquette University and the zoo's medical director, found the bear suffering from incurable kidney and liver diseases and ordered him shot.

The Washington Park Zoo is highly rated among the world's zoos. It began in the early nineties with six deer and an eagle housed in an ordinary barn still in use. The zoo moved forward in earnest in 1906, when the late Edward H. Bean resigned from the Lincoln Park Zoo at Chicago to be director at Washington Park, in which position he remained until 1927, when he became director of the Brookfield Zoo at Chicago.

In 1910, the Washington Park Zoological Society, composed of civic-minded citizens, was organized for promotion of the zoo. Through direct purchase, dona-

tions and births at the zoo, the society has given the zoo all the specimens shown there since 1910. The total value of zoo specimens and replacements has been estimated at nearly half a million dollars. More than \$600,000 have been spent by Milwaukee city and county in providing quarters for zoo specimens on forty acres of Washington Park.

In 1936 the Washington Park Zoo came under the jurisdiction of the Milwaukee County Park Commission by order of a referendum election. Plans are now under way to move the zoo to a tract of 150 acres on Milwaukee's western boundary, where it will be enlarged and modernized at an estimated cost of more than a million dollars. By use of moats and other modern equipment, specimens will be presented under conditions resembling those of their habitats.

The objective of the modernized zoo as expressed by Charles I. Wesley, industrialist and civic leader and president of the Washington Park Zoological Society, and Jerome C. Dretzka, executive secretary of the County Park Commission, will be: "Not necessarily the largest zoo but the most interesting."

Plaster casts of Sultana's head will be given places of honor in the Milwaukee Public Museum and the Washington Park Zoo's administration building.

Yankee Naturalist

Hermon Carey Bumpus, Yankee Naturalist. By Hermon Carey Bumpus, Jr. Minneapolis. 1947. University of Minnesota Press. 141 pages. Illustrated. \$2.50.

Dr. Bumpus left his indelible mark upon the pages of recent progress in the natural sciences and education. Imaginative, indefatigable and versatile, Hermon Bumpus was ever a progressive in the work of bringing the public and Nature into closer communion. As director of the Marine Biological Laboratory at Woods Hole, Massachusetts, as professor of biology at Brown University, as the first director of the American Museum of Natural History, as business manager of the University of Wisconsin, as president of Tufts College, and as chairman of the advisory board of the National Park Service, Dr. Bumpus gave wide proof of his many accomplishments. His son has here told the interesting personal and professional story of his father's career in a book that will be fascinating reading to many of Dr. Bumpus' former associates, and to any reader, particularly a Yankee.

Painting Water Color

Why Not Paint a Water Color? By Frank Stearn. New York. 1947. Sentinel Books. 94 pages. Illustrated. Sixty cents.

The title of this little book asks a question, and the text and illustration tell the reader how to answer it.

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WANDERING KINGS

(Continued from page 416)

home in southern Mexico, has a Maine record; and the West Mexican kingbird has gone north several times to Washington, and at least once to British Columbia. Most remarkable of all, because farther away from its normal range, from southern Mexico to Patagonia, are the erratic arrivals of the fork-tailed flycatcher. Its northern jaunts have brought it to attention in Mississippi, Kentucky, New Jersey, Massachusetts, and Maine.

These birds are all "tyrants"; they have energy; and it has been translated in part into far-reaching travel. Some, but not all, of this going about is the wandering of the young—a post-breeding season activity well known also in other groups of birds, especially the herons. The pioneering of the kingbirds tends to bring them to the coasts; there the water stops them and they follow it—to live, perhaps, if they go south, or doubtless to perish if they head north. If going places were the same as winning new range, the adventurous tyrant flycatchers would be first in that competition. But as their real home ranges have remained much the same within historic times, it is evident that their pioneers have been sacrificed in vain.

MONTANA'S HISTORIC BITTERROOT

(Continued from page 427)

of this plant, intensely bitter when raw and smelling like tobacco when boiling, should have secured a stable place in any human bill of fare." Many mountaineers, however, learned to relish the cooked root.

Other common names are rock rose, sand rose, mountain rose, redheaded Louisa, resurrection plant, and wild portulaca. The bitterroot belongs to the Portulaca Family.

Reproduction takes place by means of the many small, jet-black seeds, confined in a small pod, which splits into an upper and a lower part. The top of this tiny, thin-shelled capsule pops off and disappears. The seeds roll out and are scattered far and wide.

This plan of Nature for the continuance of the species seems to have been successful before the advent of white man into the Northwest. For untold centuries the bitterroot was annually dug up by various tribes. The best of the digging-grounds, such as the flats at Missoula and the nearby Bitterroot Valley, were occupied each year by several tribes at once. In spite of this tremendous amount of utilization, the supply always seemed inexhaustible.

There are even more striking ways in

which this plant exhibits its power of resurrection. The bitterroot refuses to die! The experience of Saunders was similar to that of other experimenters: "Specimens that have been dipped in boiling water, dried, and laid away in an herbarium for over a year have been known to revive on being put in the ground again, to grow and to produce flowers."

This vitality, as indicated by the plant's behavior and reflected in its specific name, *rediviva*, has created problems for herbalists. Anthon refers to his unsuccessful efforts: "It is almost impossible to obtain a good herbarium specimen as the plant seems to retain enough vigor to ripen flowers even after being dry and under a heavy weight."

The Montana voters of 1894, in selecting the bitterroot as a state flower, were strongly influenced by this characteristic. The bitterroot's tenacity for life seemed to typify the true Montana spirit.

CLARK'S NUTCRACKER

(Continued from page 431)

while searching for a water route, Clark wrote, "I saw today (a) Bird of the woodpecker kind which fed on Pine burs its Bill and tale white the wings black every other part a light brown . . ." A slightly inaccurate description but clear enough to indicate that the bird was the nutcracker.

Clark found no practical water route, but he met an Indian who led the expedition to the north and then through the Bitterroot Mountains. Moccasins froze on the men's feet, pack-horses lamed and slipped down the slopes, snow fell, and scarcity of game necessitated killing horses for food. The expedition moved on. On September 25, Lewis, scouting ahead, reached the navigable Clearwater River and canoe timber. On October 7, five completed and loaded canoes shot the first of the scores of rapids they had to pass to reach the Pacific Ocean.

THE GEORGIAN OYSTER

(Continued from page 432)

twenty or thirty feet, are composed entirely of fossil oyster shells, internally of the color of clear white marble: the shells are of incredible magnitude, generally fifteen or twenty inches in length, from six to eight wide, and two to four in thickness, and their hollows sufficient to receive an ordinary man's foot: they appear all to have been opened before the period of petrification, a transmutation they seem evidently to have suffered; they are undoubtedly very ancient or perhaps antediluvian."

This serene Quaker, who "saw with the

mind of a scientist, and the soul of a poet", has given us such a moving and accurate picture of the things he saw in these Southern states in the nearly primitive scene of that time, it would be folly to quibble about minor details. I have been unable to be quite sure what exact locality he visited, and the sizes he gives seem a little on the large side, but it may be he saw some shell bank opened by the settlers, and cut back deeper than the weathered and picked-over bank we examined.

It appeared to us that the oysters had been opened, and that all were dead, when they were covered up. Carefully we searched for the other kinds of shells one might expect to find around an oyster-bed, but only found one, a barnacle, probably *Balanus*. This crustacean (it must not be confused with the true bivalves) probably travels close to the water surface, like other crustaceans, when in the free-swimming stage, and seeks a place for permanent attachment that is not too far below the tidal level. Perhaps this oysterbed was too deep to attract many of them.

A most obvious question is why the oysters grew so large. I have asked other naturalists, and have received hints of a different species; abundantly fed, well supplied with the necessary minerals for strong shell growth, and without hampering parasites.

A few years ago there was a long descriptive poem about DeSoto, pearls, Aztec pearl traders, and the like, in which extravagant gems from the Shell Bluff oysters occurred. As a poem, it may have been successful, but some little consideration of the facts would make it less entertaining. Pearls from *Ostrea* do not have gem luster. The pearl oyster is from a different genus entirely.

Our visit to Shell Bluff was one of those rare things, a vacation trip with an objective, and it brought a vision, a glimpse, in perspective, of the development of this part of the Coastal Plain. Often we find fossil shells embedded in rock, high in altitude, but seldom are they so placed that we can see some part of how they came about in such a place.

Anniversary Yearbook

25th Anniversary Yearbook of Park and Recreation Progress. Washington, D. C. 1947. National Conference on State Parks. Illustrated. \$2.00.

The National Conference on State Parks was organized in 1921 to further the program of State Park development, and in the infancy of that movement. Last year the Conference observed its silver anniversary, and this yearbook constitutes a report of the past and of the present status of state park recreation, state by state, in the country today. It is at once a valuable guide to existing areas in this classification and to their background.

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The Puma in Vermejo Park

When the Dogs Bark "Treed." By Elliott S. Barker. Albuquerque, N. M. 1946. University of New Mexico Press. 209 pages. Illustrated. \$3.00.

This is a factual account of the activities of the author, while working with game and predators, in the employ of the Vermejo Club, from April 1, 1930 to March 31, 1931, on its 360,000-acre estate in northern New Mexico. As the mountain lion was the most important predator, the author's activities were concerned chiefly with this animal. But there are accounts of the killing of some other mammals, notably bobcats, a good many coyotes, a bear or two, and some minor species trapped accidentally. Concerning all of these may be found a great deal on habits and food. The game animals—elk, deer and turkeys—whose presence in the area were evidently the reason for the existence of the "Park," naturally come in for considerable discussion.

We look in vain for any admission that the puma has any useful or admirable qualities. Perhaps this is because the author sets out to put down facts as he found them, and the opportunities given the puma to follow any course but one of vigorous self-defense are now non-existent. Historically, the instances where this large and powerful cat has attacked man, as recorded during the few hundred years since Europeans first met with it, have been so few that one must wonder what natural impulses have been operative in its forbearance to kill humans, as compared with the myriad opportunities it has had. Naturally, man's usual present-day attitude toward most wild animals no longer gives them many opportunities to indulge in any instincts save precipitate flight or vigorous self-defense. E. A. P.

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Under the Microscope

By JULIAN D. CORRINGTON

PHOTOMICROGRAPHS FROM SLIDES COURTESY WARD'S NATURAL SCIENCE ESTABLISHMENT, INC.

THE STORY OF FERNS

II Gametophyte

THE fern prothallium, which is the gametophyte generation in this class of plants, is a small and inconspicuous object, rather difficult for the uninitiated to locate. It is green, typically heart-shaped, averages about one-quarter inch in diameter, and should be looked for on stones, walls, old logs, or the soil, in moist and shaded situations. The surfaces of flowerpots in greenhouses have long been favorite collecting sites. Experimental work has shown that the heart shape is only attained when all the conditions for growth are favorable, such as suitable amounts of light and moisture, but more especially a flat surface on which to develop and lack of crowding by other prothalli or other plants. Crowded examples are small, and irregular as to shape.

This gametophyte results from the germination of an asexual spore, produced by the leafy fern plant, the sporophyte. Each spore has two coats, an outer impervious layer that is thick and brown, and an inner thin membrane. If a spore falls upon a moist situation, as is apt to be the case in localities where ferns grow, it will germinate: the outer coat soaks up moisture, softens, and splits, as the protoplasmic contents proceeds to grow and expand. Through mitosis, a cell is budded off from the protruding protoplast, then another and another, until soon there is a short chain of cells, containing chloroplasts, and representing the first appearance of the prothallium. The first cell, next to the spore case, and the oldest one of the series, produces a long filamentous outgrowth from its side wall. This is hair-like, colorless, and is the first rhizoid. Others then appear, from the older cells, while the growing tip of the prothallium expands into a flat heart shape, with an apical notch at the outermost or youngest termination.

This affair is only one cell in thickness except just in rear of the apical notch, where a *cushion*, several cells thick, occurs. In a short time this growth has been completed, and sex organs appear. The male organs, or antheridia, develop first and may occur almost anywhere on the under surface of the prothallus, but tend to lie among the rhizoids in the older part, opposite the apical notch. If the prothallus has



Fern gametophyte, 28X. Dark objects in center are archegonia.

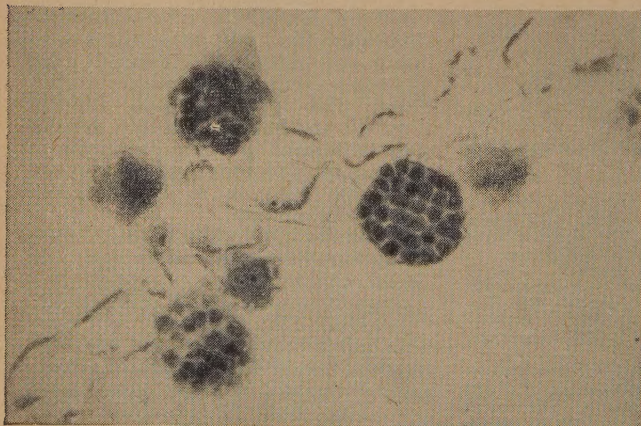
been crowded and is small and irregular, it will produce only antheridia; if it develops fully into the larger heart shape, the female organs, or archegonia, will also appear on the under surface of the cushion, just back of the notch.

An individual antheridium is a very small mound, with a single layer of external cells, comprising the *jacket*. Within the cells undergo repeated mitoses, eventually forming many sperm cells or *antherozoids*, so-called because moving about when liberated, after the fashion of protozoa, or free-living animal cells. The sperm looks like a miniature question mark with many long flagella. When these antherozoids are mature and in wet weather, the jacket ruptures and the sperms swim away in search of archegonia. Inasmuch as the egg cells of the same prothallus are not ordinarily ripe at the same time, cross-fertilization is the rule.

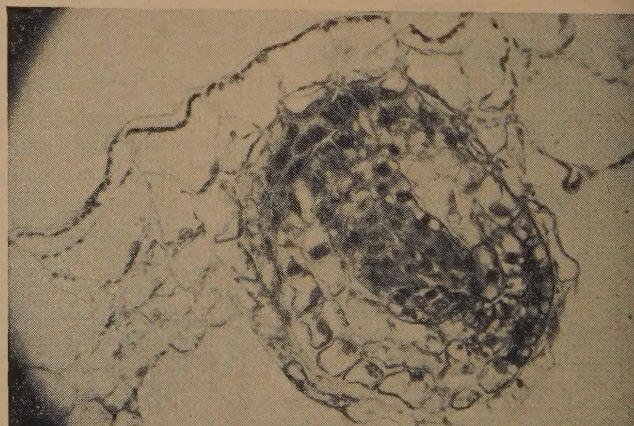
The archegonium is much larger than the male organ and resembles a flask. The base is the *venter* (belly), embedded as a part of the cushion, the protruding portion is the *neck*, comprising a single layer of cells surrounding a future *canal* and a single row of *neck canal cells* plugging this passageway until the egg is mature. The *ovum* or egg cell looks, in early stages, like the first of the row of neck canal cells, but is larger and polygonal. At maturity, the neck canal cells and terminal jacket cells disintegrate, opening up the canal; whereupon, in wet weather, sperms swim up this tube and one of them unites with the egg cell, forming a *zygote*, the beginning of the sporophyte generation.

The entire gametophyte generation is monoploid in chromosome number, having but a single set. The fertilized egg, bringing together a set from the sperm cell and another set from the egg, is diploid, a condition characterizing the sporophyte generation.

Slide preparations for the gametophyte generation include



Section through antheridia showing coiled sperms, 550x.



Section through archegonium with embryo sporophyte, 225x.

ole mounts of the prothallus, preferably mature ones with both antheridia and archegonia, and vertical sections through each of these sex organs. A more detailed study would require a number of stages in the development of the prothallus as a whole, from spore germination onward, and of the two sex organs, from first appearance to maturity.

Gametophytes collected from the woods or greenhouses can be used. However, it is practically impossible to remove particles of soil from the rhizoids. Unless nearly all adhering soil particles can be washed off, they will obscure the gametophyte and render it far from perfect; and any soil at all makes the specimen unfit for sectioning, since such particles will nick the microtome knife and mar the plant tissues.

For these reasons, technicians prefer to grow their own prothalli by sowing spores on nutrient agar in petri dishes, by the Costello method. This procedure, described and illustrated in Chamberlain's well-known *Methods in Plant Histology*, uses the following setup: Fill a clean and porous flowerpot with wet sphagnum moss; wet the outside of the pot and invert it in a dish of water; sow the spores on the pot and cover with a bell jar to make a moist chamber for the whole. The only further attention needed is to see that there is always water standing in the dish. The spores germinate promptly, and individual prothalli may be removed for mounting at any desired stage; mature prothalli with both antheridia and archegonia should be present in about one month, the time depending on the species.

Place several prothalli in a small, wide-mouthed bottle and fill with a weak chrome-acetic for killing and fixing. The simplest formula is: 50 parts each of 1% chromic acid and 1% acetic acid. Fix for 24 hours, then pour off the fixative and flush the bottle gently several times under a tap to rinse. Place a square of cheesecloth over the mouth of the bottle, secured around the neck with a rubber band, cut a small hole in the center of this cloth, and push through a pipette (medicine dropper), which is connected by rubber tubing to the faucet. See that the tip of the pipette reaches almost to the bottom of the bottle, and adjust the tap to deliver a very gentle, but much more than drop-by-drop, stream, washing in this manner for overnight.

Carefully remove the specimens to a flat stender or similar piece of glassware, and thereafter add and remove reagents with a pipette so as to avoid all possible handling of the delicate prothalli. Dehydrate through a rather closely graded series of alcohols, preferably 15, 30, 50, and 70% ethyl alcohol, 30 minutes each, then into a 1% solution of safranin in 5% alcohol for 24 hours. Rinse with 5% alcohol several times to get rid of excess safranin; counterstain with 1%

fast green in 95% alcohol until of a bright, clear green color, rinse well with fresh 95% alcohol, then pipette in 3 parts 95% alcohol and 1 part hygrobutol, which is an especially prepared form of tertiary butyl alcohol; if unobtainable, use the latter. After one hour, change the solution to one of half-and-half alcohol and hygrobutol. After another hour, remove this solution and pipette in pure hygrobutol, changing this twice to fresh hygrobutol at 15-minute intervals.

After completing this dehydration, change to 5% balsam in hygrobutol and allow this to evaporate slowly in a warm, dust-free situation. The hygrobutol evaporates and care must be taken that the plants are covered with the mixture at all times, adding more if necessary. When the evaporation has proceeded to the point where the balsam is just slightly thinner than that ordinarily used for mounting, take a spatula and transfer a prothallus carefully to the center of a clean slide, together with some of the balsam. Orient the gametophyte gently, bottom surface up and well spread out, then add a cover glass slowly so as to keep the specimen centered and to avoid inclusion of air bubbles. Sectioning techniques will be taken up in our next installment, along with a description of the sporophyte generation.

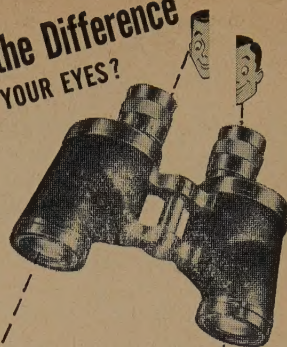
BIOLOGICAL LABORATORY MANUALS

Zoology Professor Alfred M. Elliott, of State Teachers College, Bemidji, Minnesota, whose *Atlas in General Zoology* is favorably known, has produced a fine modern manual, *Laboratory Guide for Animal Biology*. As one glances through the volume in preliminary fashion, the eye is caught by the numerous striking drawings, by Miss Olivia Jensen. Closer inspection reveals the author's design in these drawings of stressing clarity and showing only those parts that the student should be able to find in his specimens, omitting minor structures and excessive detail to avoid the confusion so often present in drawings that attempt to include everything in a single view. The more complex dissections are completely drawn and labeled and serve as a guide to the student in learning the work. He is not allowed to get off thus easily in the matter of drawings, however, and he must make others, from different aspects or species, and must complete certain others.

The directions are clear and concise. The book is intended for the general student, but without sacrifice of the detailed information needed by the professional. All animal groups are covered and there are, in addition, sections on the microscope, cell, mitosis, embryology, histology, and physiology. We believe this manual strikes the happy medium in amount and character of both

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instructions and drawings and attempts as far as it is possible in a beginning course to teach the student self-reliance in his laboratory work. Pp. iv, 274; plts. 45, many figs. Burgess Pub. Co., 426 S. 6th St., Minneapolis 15, 1946. \$2.75.

Embryology Very thorough in scope and profusely illustrated is *A Laboratory Manual of Vertebrate Embryology*, 3d edition, by Professor Roberts Rugh, of Washington Square College, New York University. The plan follows that, now almost universal in adoption, of providing the student with a considerable number of complete and fully labeled drawings, to assist in the interpretation of his laboratory findings; of complete drawings to be labeled; of outline drawings to be completed and labeled; and of blank spaces for wholly original drawings. The student's time is conserved, especially important in the embryology course, where so much attention is sometimes paid to making the very considerable number of required drawings, that the course is in danger of becoming one in drawing rather than in embryology.

The directions are full, yet concise and to the point. There are questions to answer, references to the standard texts, experiments, tables to fill, many photomicrographs, a wealth of carefully executed drawings, and a very fine, 38-page glossary, serving almost as a text on the subject. The various chapters cover maturation, fertilization, early development, amphioxus, fish, and a summary of human development, together with detailed treatment, comprising the bulk of the volume, on the frog, chick, and pig. The charts and tables on classification of embryonic types and derivation of parts are especially helpful to the student. Pp. x, 229. Burgess Pub. Co., 426 S. 6th St., Minneapolis 15, 1946. \$2.25.

HISTORICAL OUTLINE

The retting of flax is an old process, not understood until recent times. To ret is to rot in water by soaking, and involves the partial decomposition of raw flax, so as to remove the softer tissues and leave behind the fine fiber which constitutes the linen thread, sold on the spool for sewing, or woven into such linen fabrics as cambric or lawn, or made into lace, as Irish. Hemp fibers must be treated in similar fashion. It is now known that the pectin in these fibers must be decomposed through the action of the enzyme pectinase, brought about by a group of bacteria termed the amylobacter group, closely related to anaerobic soil species.

Leather tanning, aside from that done wholly by chemicals, includes treatment of skins with tannic acid derived from chips of oak, hemlock, willow, or other bark. The acid preserves the corium, or true skin, and renders it tougher and less permeable, though details of treatment and results differ greatly according to the kind of leather wanted. Formerly the tanning liquor was impregnated with bacteria, unwittingly, by adding dung; now the mold *Aspergillus* is placed in the liquor, along with enzymes that attack proteins.

The curing of tobacco leaves is not yet wholly understood, but it is believed that in the sweating process, enzymes present in the leaves, along with those of numerous microorganisms, all participate in fermentations that impart characteristic aromas and flavors. *Pseudomonas fluorescens* and *Proteus vulgaris* are two bacterial species, and *Aspergillus* a mold that, with others, play their part in this procedure.

Another important modern division of work with microorganisms is dairy bacteriology. This branch has to do not

only with the bacterial content of milk and the possible inclusion of such pathogens as those causing undulant fever or tuberculosis, but also with certain bacteria, as *Streptococcus lactis*, purposely added to ripen and flavor some types of butter. *Streptococcus thermophilus* is used as a "starter" in making Swiss cheese; *S. cremoris* is another starter in butter and cheese manufacture; *Lactobacillus acidophilus* and *L. bulgaricus* and others are used in the souring and fermenting of milk, as in the making of Bulgarian milk, kefir, yogurt (or yohourt), and kumiss (or koumiss), which are variously flavored liquid or semisolid products, supposedly healthful, sometimes alcoholic. The aromas and flavors of many cheeses are due to peptonizing bacteria and to such molds as *Penicillium*, e.g., *P. roqueforti*.

Sewage disposal is still another application of the same principle of bacterial action on organic material. Regardless of the type of sewerage employed, the basic plan is digestion by bacterial enzymes, converting the complex to simpler products. The biologist employs bacteria in this fashion when he macerates (soaks) an animal carcass in water to soften and remove fleshy tissues in the preparation of a skeleton. Let us say the student wishes to prepare a mounted skeleton of a cat. The dead animal is first skinned, then the viscera and bulkier muscles removed in a "roughing out" procedure. The finer work would, however, be almost impossible if it were not for the softening of the muscles and especially the tendons and ligaments by maceration. Bacteria go to work on these tissues, decomposing them in a fermenting process termed putrefaction, actually a form of digestion. The dissolution of dead bodies, both animal and plant, thus depends on bacteria. Not only is the surface of the earth kept from becoming a vast charnel house, but the carbon and nitrogen locked up in the bodies of living animals and plants is released and returned to the soil, whence the soil bacteria make them again available for new generations, as we have seen.

The gist of this knowledge is new to science, but not to art. Listen to the voice of Omar, speaking to us out of the Twelfth Century:

"I sometimes think that never blows so red
"The Rose as where some buried Caesar bled;
"That every Hyacinth the Garden wears
"Dropt in her Lap from some once lovely Head. (XIX)

"And this reviving Herb whose tender Green
"Fledges the River-Lip on which we lean—
"Ah, lean upon it lightly! for who knows
"From what once lovely Lip it springs unseen! (XX)

"For I remember stopping by the way
"To watch a Potter thumping his wet Clay:

"And with its all-obliterated Tongue
"It murmur'd—'Gently, Brother, gently, pray!' (XXXVII)

"And fear not lest Existence closing your
"Account, and mine, should know the like no more;
"The Eternal Saki from that Bowl has pour'd
"Millions of Bubbles like us, and will pour (XLVI)

"When You and I behind the Veil are past,
"Oh, but the long, long while the World shall last,
"Which of our Coming and Departure heeds
"As the Sea's self should heed a pebble-cast." (XLVII)
—Rubaiyat of Omar Khayyam